NOAA.NOS
ELMR
Report No. 12

NOAA's Estuarine Living Marine Resources Program

Distribution and Abundance of Fishes and Invertebrates in Mid-Atlantic Estuaries

March 1994

U.S. Department of Commerce
National Oceanic and Atmospheric Administration
National Ocean Service

QL
621.5
.D57
no.12

NOAA's Estuarine Living Marine Resources Program

The Strategic Environmental Assessments (SEA) Division of NOAA's Office of Ocean Resources Conservation and Assessment (ORCA) was created in response to the need for comprehensive information on the effects of human activities on the Nation's coastal ocean. The SEA Division performs assessments of the estuarine and coastal environments and of the resources of the U.S. Exclusive Economic Zone.

In June 1985, NOAA began a program to develop a comprehensive data base on the life history, relative abundance, and distribution of fishes and invertebrates in estuaries throughout the Nation (Monaco 1986). The Estuarine Living Marine Resources (ELMR) program has been conducted jointly by the SEA Division, the National Marine Fisheries Service (NMFS), and other agencies and institutions. The Nationwide ELMR data base was completed in January 1994, and includes data for 135 species found in 122 estuaries and coastal embayments. Seven reports and reprints are now available free upon request, and two others are scheduled for completion in 1994 (see below). This report, *Distribution and Abundance of Fishes and Invertebrates in Mid-Atlantic Estuaries*, summarizes information on the distribution and abundance of 61 fish and invertebrate species in 22 Mid-Atlantic estuaries. A National report summarizing the data and results from the program will be published in 1995.

Three salinity zones, as defined in Volume 1 of NOAA's *National Estuarine Inventory Data Atlas* (NOAA 1985), provided the spatial framework for organizing information on species distribution and abundance within each estuary. These salinity zones are tidal fresh (0.0 to 0.5 ppt), mixing (0.5 to 25 ppt), and seawater (>25 ppt). The primary data developed for each species include spatial distribution by salinity zone, temporal distribution by month, and relative abundance by life stage, e.g., adult, spawning, juvenile, larva, and egg.

Additional information on this or other programs of NOAA's SEA Division is available from:

NOAA/NOS Strategic Environmental Assessments Division
1305 East-West Hwy., 9th Floor, N/ORCA1
Silver Spring, Maryland 20910
Phone (301) 713-3000
Fax (301) 713-4384

Selected reports and reprints available from NOAA's Estuarine Living Marine Resources program include:

Monaco, M.E., et al. 1990. Distribution and abundance of fishes and invertebrates in west coast estuaries, Vol. I: data summaries. ELMR Rep. No. 4. NOAA/NOS Strategic Assessment Branch, Rockville, MD. 240 p.

Emmett, R.L., et al. 1991. Distribution and abundance of fishes and invertebrates in west coast estuaries, Vol. II: species life history summaries. ELMR Rep. No. 8. NOAA/NOS Strategic Environmental Assessments Division, Rockville, MD. 329 p.

Nelson, D.M., et al. 1991. Distribution and abundance of fishes and invertebrates in southeast estuaries. ELMR Rep. No. 9. NOAA/NOS Strategic Environmental Assessments Division, Rockville, MD. 177 p.

Monaco, M.E., et al. 1992. Assemblages of U.S. west coast estuaries based on the distribution of fishes. Journal of Biogeography 19: 251-267.

Nelson, D.M. (editor), et al. 1992. Distribution and abundance of fishes and invertebrates in Gulf of Mexico estuaries, Vol. I: data summaries. ELMR Rep. No. 10. NOAA/NOS Strategic Environmental Assessments Division, Rockville, MD. 273 p.

Bulger, A.J., et al. 1993. Biologically-based salinity zones derived from a multivariate analysis. Estuaries 16: 311-322.

Pattillo, M.E., et al. In prep. Distribution and abundance of fishes and invertebrates in Gulf of Mexico estuaries, Vol. II: species life history summaries. ELMR Rep. No. 11. NOAA/NOS Strategic Environmental Assessments Division, Silver Spring, MD.

Stone, S.L., et al. 1994. Distribution and abundance of fishes and invertebrates in Mid-Atlantic estuaries. ELMR Rep. No. 12. NOAA/NOS Strategic Environmental Assessments Division, Silver Spring, MD. 280 p.

Jury, S.H., et al. In prep. Distribution and abundance of fishes and invertebrates in North Atlantic estuaries. ELMR Rep. No. 13. NOAA/NOS Strategic Environmental Assessments Division, Silver Spring, MD.

Distribution and Abundance of Fishes and Invertebrates in Mid-Atlantic Estuaries

Project Team

Steven L. Stone, Tony A. Lowery, John D. Field,
Steven H. Jury, David M. Nelson*, and Mark E. Monaco
Biogeographic Characterization Branch
Strategic Environmental Assessments Division
Office of Ocean Resources Conservation and Assessment
National Ocean Service
Silver Spring, MD 20910

Christopher D. Williams
Virginia Institute of Marine Science
College of William and Mary
Gloucester Point, VA 23062

Linda Andreasen
Oxford Laboratory
Northeast Fisheries Science Center
National Marine Fisheries Service
Oxford, MD 21654

MBL/WHOI
0 0301 0087510 0

ELMR Report Number 12

March 1994

DOCUMENT
LIBRARY
Woods Hole Oceanographic
Institution

* contact for copies of this report.

This report should be cited as:
Stone, S.L., T.A. Lowery, J.D. Field, C.D. Williams, D.M. Nelson, S.H. Jury, M.E. Monaco, and L. Andreasen. 1994. Distribution and abundance of fishes and invertebrates in Mid-Atlantic estuaries. ELMR Rep. No. 12. NOAA/NOS Strategic Environmental Assessments Division, Silver Spring, MD. 280 p.

Contents

Introduction 1

Rationale 1

Data Collection and Organization 2

- Selection of estuaries 2
- Selection of species 3
- Data sheets 5
- Data verification 6

Results 6

- Presence/absence of ELMR species 6
- Data summaries 6
- Seasonal comparisons 6

Data Content and Quality 7

- Variability in space and time 7
- Life history notes 13

Coupling of Estuarine and Marine Ecosystems 16

- Classifying and comparing estuaries 16
- Linkages to marine ecosystems 16
- East Coast of North America Strategic Assessment Project 17

Acknowledgments 17

Literature Cited 17

Data Summary Tables 19

- Table 4. Spatial distribution and relative abundance 21
- Table 5. Temporal distribution and relative abundance 67
- Table 6. Data reliability 157

Appendices 191

- Appendix 1. National Estuarine Inventory map of Delaware Bay 193
- Appendix 2. Table of references and personal communications 194
- Appendix 3. Reviewers and personal communications 239
- Appendix 4. References 245

List of Figures

Figure 1. ELMR study regions and regional research institutions.
Figure 2. Major steps taken to complete the Mid-Atlantic ELMR study.
Figure 3. ELMR Mid-Atlantic estuaries.
Figure 4. Example of a species/estuary data sheet: American shad in Delaware Bay.
Figure 5. Number of species by estuary, salinity zone, and life stage.
Figure 6. Number of species by salinity zone, life stage, and month.

List of Tables

Table 1. ELMR Mid-Atlantic estuaries and associated salinity zones.
Table 2. ELMR Mid-Atlantic species.
Table 3. Presence/absence of ELMR species in Mid-Atlantic estuaries.
Table 4. Spatial distribution and relative abundance.
Table 5. Temporal distribution and relative abundance.
Table 6. Data reliability.

Introduction

This report presents information on the spatial and temporal distribution, and relative abundance of 61 fish and invertebrate species in 22 estuaries along the U.S. Atlantic coast from Virginia to Massachusetts. Its purpose is to disseminate data developed in the National Oceanic and Atmospheric Administration's (NOAA) Estuarine Living Marine Resources (ELMR) program (inside front cover). The ELMR program is conducted by the Biogeographic Characterization Branch of the Strategic Environmental Assessments (SEA) Division, in cooperation with regional research institutions (Figure 1). The presence, distribution, and relative abundance of each species and the time period it utilizes each estuary are the primary data compiled. The data and framework presented in this report are illustrative of the nationwide ELMR program.

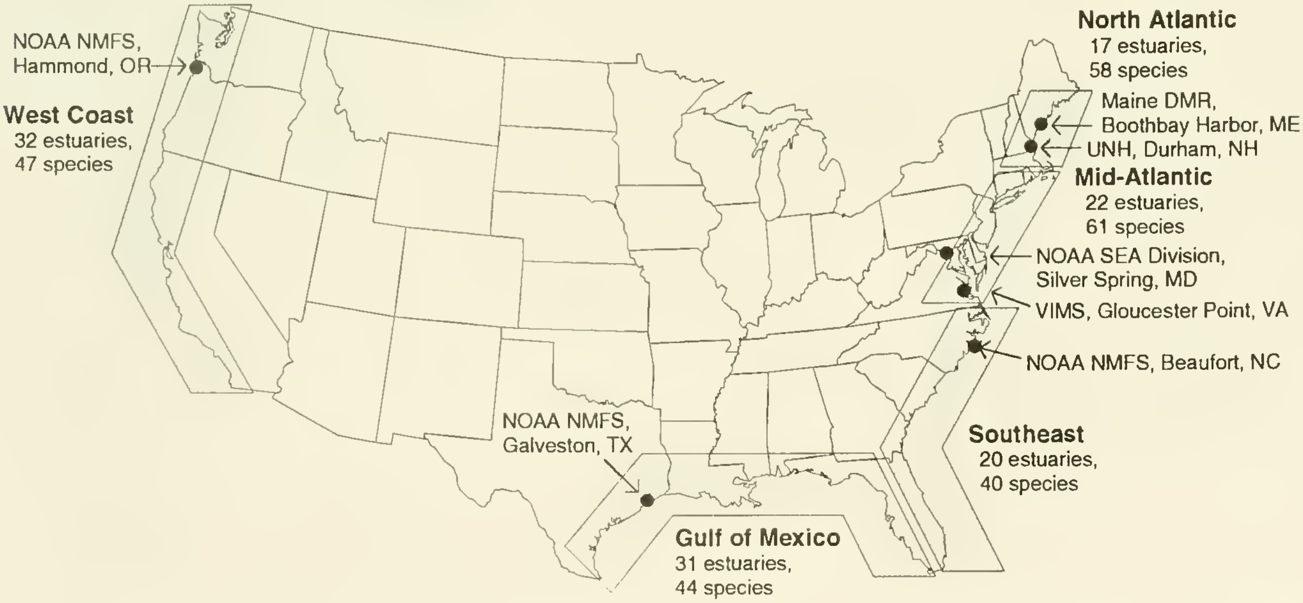
The objective of the ELMR program is to develop a consistent data base on the distribution, abundance, and life history characteristics of important fishes and invertebrates in the Nation's estuaries. The Nationwide data base is divided into five study regions (Figure 1). The data base contains the monthly relative abundance of each species' life stage by estuary for three salinity zones (seawater, mixing, and tidal fresh) identified in NOAA's National Estuarine Inventory (NEI) Data Atlas-Volume I (NOAA 1985). The Nationwide data base contains information for 135 fish and invertebrate species found in 122 U.S. estuaries.

Rationale

Estuaries are among the most productive natural systems and are important nursery areas that provide food, refuge from predation, and valuable habitat for many species (Gunter 1967, Joseph 1973, Weinstein 1979, Mann 1982). Estuarine organisms that support important commercial and recreational fisheries include molluscs, crustaceans, and fishes. In spite of the well-documented importance of estuaries to fishes and invertebrates, few consistent and comprehensive data bases exist which allow examinations of the relationships between estuarine species found in or among groups of estuaries. Furthermore, much of the distribution and abundance information for estuarine-dependent species (i.e., species that require estuaries during their life cycle) is for offshore life stages and does not adequately describe estuarine distributions (Darnell et al. 1983, NOAA 1988).

Only a few comprehensive sampling programs collect fishes and invertebrates with identical methods across groups of estuaries within a region. Therefore, most existing estuarine fisheries data cannot be compared among estuaries because of the variable sampling strategies. In addition, existing research programs do not focus on how groups of estuaries may be important for regional fishery management, and few compile information for species having little or no economic value.

Figure 1. ELMR study regions and regional research institutions.



Because life stages of many species use both estuarine and marine habitats, information on distribution, abundance, temporal utilization, and life history characteristics are needed to understand the coupling of estuarine, nearshore, and offshore habitats. To date, a national data base of this type does not exist. Consequently, the ELMR program was developed to integrate fragments of information on marine and estuarine species and their associated habitats into a useful, comprehensive, and consistent format. Results from this program will complement NOAA efforts to develop a national estuarine assessment capability (NOAA 1985), identify information gaps, and assess the content and quality of existing estuarine fisheries data.

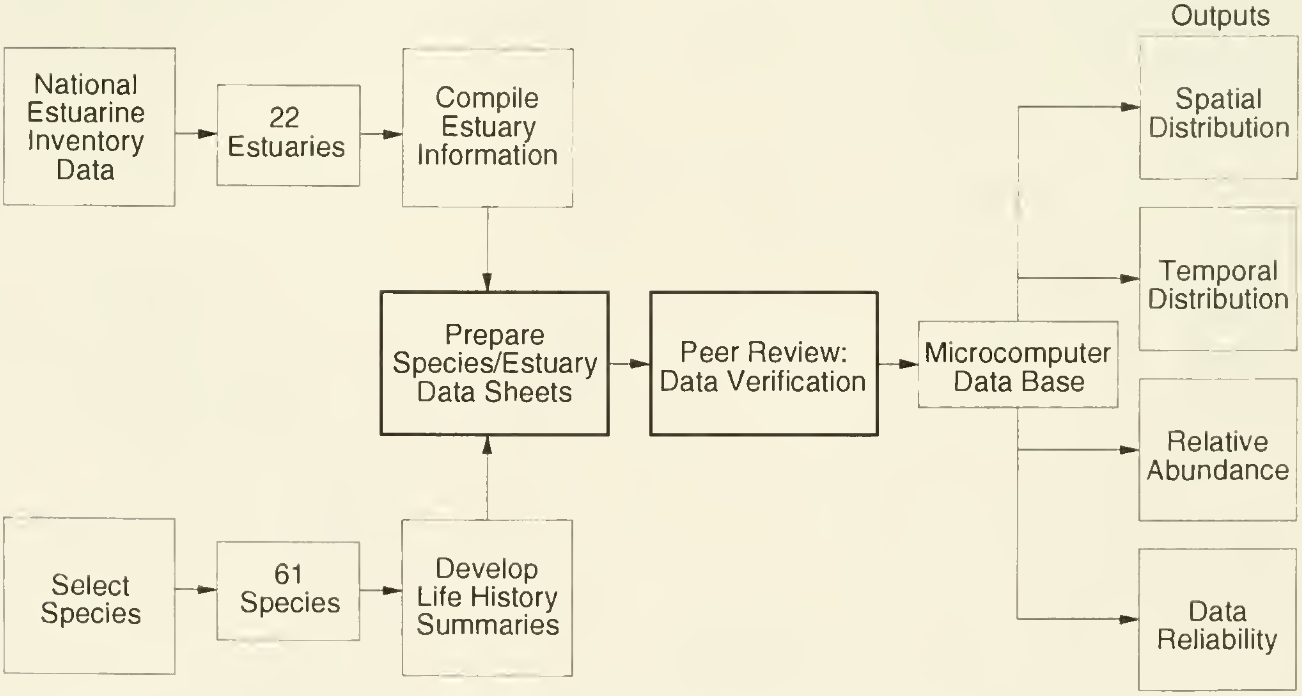
Data Collection and Organization

Figure 2 summarizes the major steps taken to collect and organize information on the distribution and abundance of fishes and invertebrates in Mid-Atlantic estuaries. The initial steps were selection of the estuaries and species to be studied.

Selection of Estuaries. Mid-Atlantic estuaries were selected from the National Estuarine Inventory (NEI) Data Atlas - Volume I (NOAA 1985), with the addition of Waquoit Bay, New Jersey Inland Bays, and Delaware Inland Bays. The 22 estuaries selected are listed in Table 1, and their locations shown in Figure 3.

Data on spatial and temporal distributions of species were developed and organized by the tidal fresh (0.0 to 0.5 parts per thousand (ppt)), mixing (0.5 to 25.0 ppt), and seawater (>25.0 ppt) zones delineated for each estuary in the NEI. Each of the three salinity zones are represented in 7 of the Mid-Atlantic estuaries, but 15 estuaries are missing at least one zone (Table 1). For example, Delaware Bay contains all three zones, whereas Chincoteague Bay is considered as entirely seawater. A representative map and data table (Delaware Bay) from the NEI Data Atlas is shown in Appendix 1, p. 193.

Figure 2. Major steps taken to complete the Mid-Atlantic ELMR study.


Outputs
National Estuarine Inventory Data
22 Estuaries
Compile Estuary Information
Prepare Species/Estuary Data Sheets
Peer Review: Data Verification
Microcomputer Data Base
Spatial Distribution
Temporal Distribution
Relative Abundance
Data Reliability
Select Species
61 Species
Develop Life History Summaries

Compiling consistent data nationwide limits the amount of information that may be compiled for each species and estuary. Also, it would be time and cost prohibitive to map each species by life stage for each estuary (Monaco 1986). The ELMR framework, however, enables a timely, consistent compilation and organization of available information on the distribution of fishes and invertebrates in estuaries.

Selection of Species. Four criteria were used to select 61 species that had sufficient available information for inclusion in the ELMR data base. The four criteria were:

1) Commercial value: determined by review of catch data and value statistics from NMFS and state agencies, e.g., northern quahog (*Mercenaria mercenaria*), blue crab (*Callinectes sapidus*), and Atlantic menhaden (*Brevoortia tyrannus*).

2) Recreational value: defined as a species that recreational fishermen specifically try to catch, that may or may not be of commercial importance. Recreational species were determined by consulting regional experts and NMFS reports, e.g., striped bass (*Morone saxatilis*), and bluefish (*Pomatomus saltatrix*).

3) Indicator species of environmental stress: identified from the literature, discussions with fisheries experts, and from monitoring programs such as NOAA's National Status and Trends Program (O'Connor 1990). These species, e.g., American oyster (*Crassostrea virginica*), and Atlantic croaker (*Micropogonias undulatus*), are filter-feeding molluscs or demersal fishes that consume benthic invertebrates or have a strong association with bottom sediments. Their physiological disorders, morphological abnormalities, and bioaccumulation of contaminants indicate episodes of environmental pollution and/or stress.

4) Ecological value: based on several attributes, including trophic level, relative abundance, and importance as a key predator or prey species, e.g., grass shrimp (*Palaemonetes pugio*), and bay anchovy (*Anchoa mitchilli*).

The selected species are listed in Table 2, p. 4. In some cases, two or more closely related species were considered as a single unit, e.g., skates (*Raja* species), primarily because of the lack of species-specific fisheries data. These cases are described in the *Life History Notes* section of this report, pp. 13-16.

Figure 3. ELMR Mid-Atlantic estuaries.

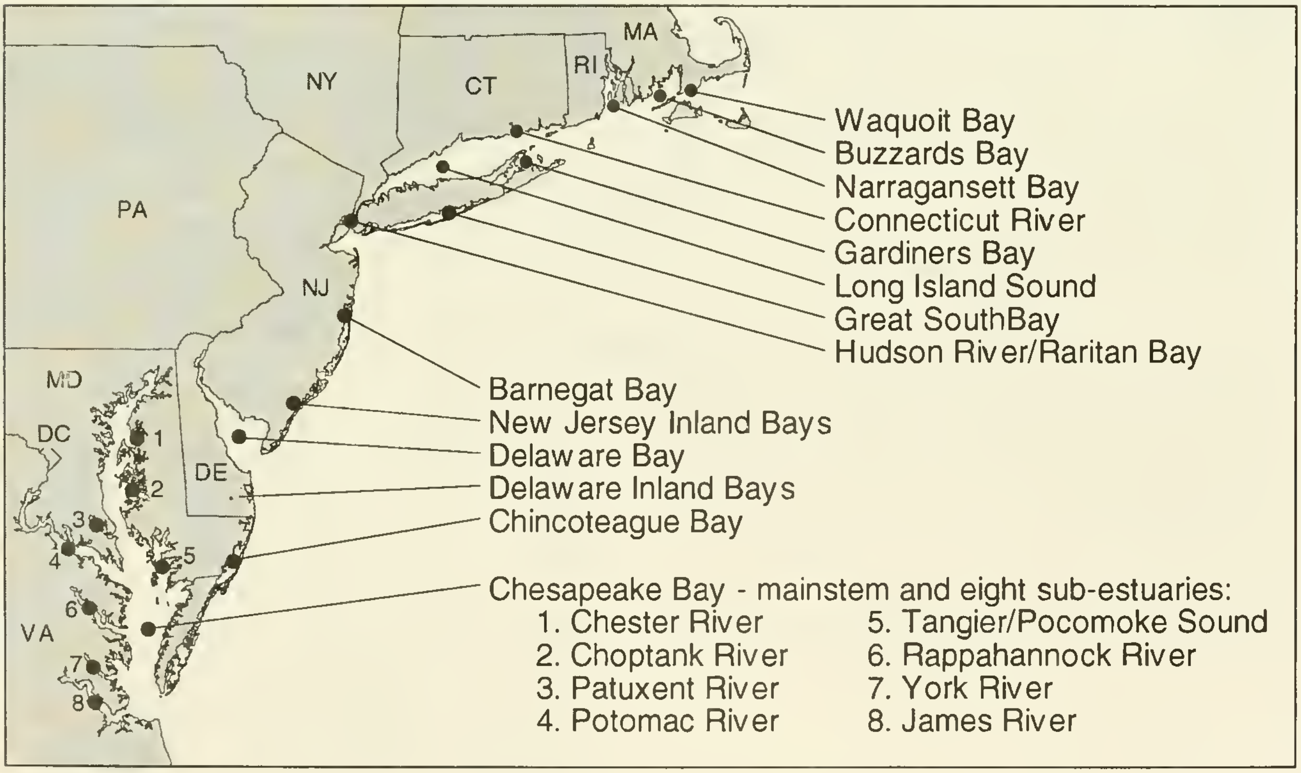


Table 1. ELMR Mid-Atlantic estuaries (n=22) and their associated salinity zones.

Estuary name, State(s)	Zones present		
Waquoit Bay, MA	*	M	S
Buzzards Bay, MA	*	M	S
Narragansett Bay, RI/MA	T	M	S
Long Island Sound, CT/NY	T	M	S
Connecticut River, CT	T	M	*
Gardiners Bay, NY	*	M	S
Great South Bay, NY	*	M	S
Hudson River/Raritan Bay, NY/NJ	T	M	S
Barnegat Bay, NJ	T	M	S
New Jersey Inland Bays, NJ [a]	T	M	S
Delaware Bay, DE/NJ/PA	T	M	S
Delaware Inland Bays, DE [b]	*	M	S
Chincoteague Bay, MD/VA	*	*	S
Chesapeake Bay mainstem, MD/VA	T	M	S
Chester River, MD	T	M	*
Choptank River, MD	T	M	*
Patuxent River, MD	T	M	*
Potomac River, MD/VA/DC	T	M	*
Tangier/Pocomoke Sound, MD/VA	*	M	*
Rappahannock River, VA	T	M	*
York River, VA	T	M	*
James River, VA	T	M	*

T - Tidal fresh zone
M - Mixing zone
S - Seawater zone
* - salinity zone not present

---

[a] The New Jersey Inland Bays system includes Little Egg Harbor, Great Bay (Mullica River), Little Bay, Grassy Bay, Reed Bay, Absecon Bay, Lakes Bay, Shelter Island Bay, Scull Bay, Great Egg Harbor, Peck Bay, Ludlam Bay, Townsend Sound, Stites Sound, Great Sound, Jenkins Sound, Grassy Sound, Richardson Sound, Jarvis Sound, and Cape May Harbor.

[b] The Delaware Inland Bays system includes Rehoboth Bay, Indian River Bay, and Little Assawoman Bay.

Table 2. ELMR Mid-Atlantic species (n=61)

Common name	Scientific name
Blue mussel	*Mytilus edulis*
Bay scallop	*Argopecten irradians*
American oyster	*Crassostrea virginica*
Northern quahog	*Mercenaria mercenaria*
Softshell clam	*Mya arenaria*
Brown shrimp	*Penaeus aztecus*
Daggerblade grass shrimp	*Palaemonetes pugio*
Sevenspine bay shrimp	*Crangon septemspinosa*
American lobster	*Homarus americanus*
Blue crab	*Callinectes sapidus*
Skates	*Raja* species
Atlantic stingray	*Dasyatis sabina*
Cownose ray	*Rhinoptera bonasus*
Shortnose sturgeon	*Acipenser brevirostrum*
Atlantic sturgeon	*Acipenser oxyrhynchus*
American eel	*Anguilla rostrata*
Blueback herring	*Alosa aestivalis*
Alewife	*Alosa pseudoharengus*
American shad	*Alosa sapidissima*
Atlantic menhaden	*Brevoortia tyrannus*
Atlantic herring	*Clupea harengus*
Bay anchovy	*Anchoa mitchilli*
Channel catfish	*Ictalurus punctatus*
Rainbow smelt	*Osmerus mordax*
Atlantic salmon	*Salmo salar*
Atlantic cod	*Gadus morhua*
Haddock	*Melanogrammus aeglefinus*
Atlantic tomcod	*Microgadus tomcod*
Pollock	*Pollachius virens*
Red hake	*Urophycis chuss*
Oyster toadfish	*Opsanus tau*
Sheepshead minnow	*Cyprinodon variegatus*
Killifishes	*Fundulus* species
Silversides	*Menidia* species
Northern pipefish	*Syngnathus fuscus*
Northern searobin	*Prionotus carolinus*
White perch	*Morone americana*
Striped bass	*Morone saxatilis*
Black sea bass	*Centropristis striata*
Yellow perch	*Perca flavescens*
Bluefish	*Pomatomus saltatrix*
Pinfish	*Lagodon rhomboides*
Scup	*Stenotomus chrysops*
Spotted seatrout	*Cynoscion nebulosus*
Weakfish	*Cynoscion regalis*
Spot	*Leiostomus xanthurus*
Northern kingfish	*Menticirrhus saxatilis*
Atlantic croaker	*Micropogonias undulatus*
Black drum	*Pogonias cromis*
Red drum	*Sciaenops ocellatus*
Mullets	*Mugil* species
Tautog	*Tautoga onitis*
Cunner	*Tautogolabrus adspersus*
American sand lance	*Ammodytes americanus*
Gobies	*Gobiosoma* species
Atlantic mackerel	*Scomber scombrus*
Butterfish	*Peprilus triacanthus*
Summer flounder	*Paralichthys dentatus*
Windowpane flounder	*Scophthalmus aquosus*
Winter flounder	*Pleuronectes americanus*
Hogchoker	*Trinectes maculatus*

Data Sheets. ELMR Program staff conducted exhaustive literature reviews to collect existing information on species abundance and distribution. Recent literature best described the present status of species in each estuary, but comparison of new literature with older historical data sets showed longer-term variations. Refereed journal articles, finfish/shellfish surveys, environmental impact statements, and graduate theses constituted most of the material examined. Additional data was often derived from "gray" literature and personal communications. A data sheet was then developed for each of the 61 species in each estuary to enable quick data compilation and presentation. Figure 4 depicts the data sheet for American shad in Delaware Bay. Data compiled for each species/life stage included: 1) the salinity zones it occupies (seawater, mixing, tidal fresh), 2) the months it is present in those zones, and 3) its relative abundance in each month and each zone. Program staff consulted with local experts to peer review each data sheet. After final edits were made, all ELMR data sheets were entered into a microcomputer data base.

The following categories were used to describe the relative abundance of each species:

- Not present: species or life history stage not found, questionable data as to identification of species, recent loss of habitat or environmental degradation suggests absence, or salinity zone not present in estuary.

- No information available: no existing data available, and after expert review it was determined that not even an educated guess would be appropriate.

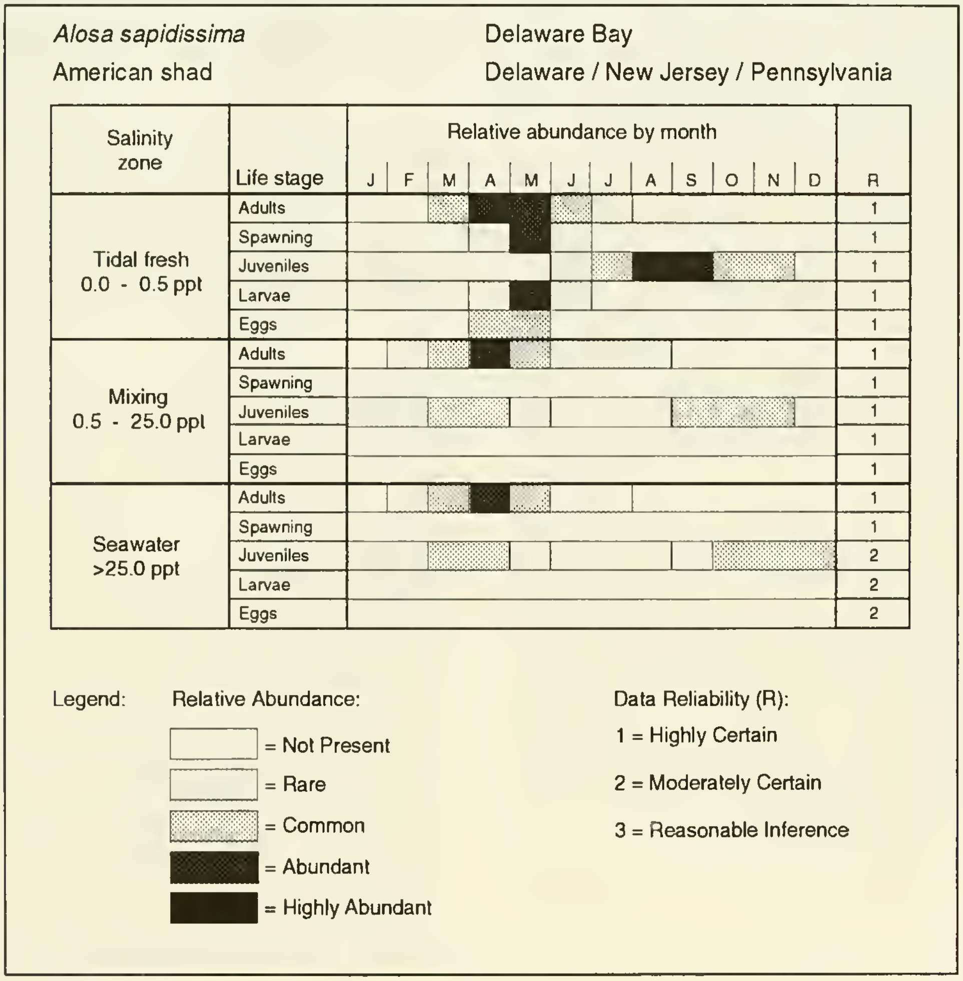
- Rare: species is definitely present but not frequently encountered.

- Common: species is frequently encountered but not in large numbers; does not imply a uniform distribution over a specific salinity zone.

- Abundant: species is often encountered in substantial numbers relative to other species.

- Highly abundant: species is numerically dominant relative to other species.

Figure 4. Example of a species/estuary data sheet: American shad in Delaware Bay.



Alosa sapidissima | Delaware Bay
American shad | Delaware / New Jersey / Pennsylvania

Salinity zone	Life stage	J	F	M	A	M	J	J	A	S	O	N	D	R
Tidal fresh 0.0 - 0.5 ppt	Adults			░	█	▓	░							1
	Spawning					█								1
	Juveniles							░	█	█	░	░		1
	Larvae					█								1
	Eggs				░	░								1
Mixing 0.5 - 25.0 ppt	Adults			░	█	░								1
	Spawning													1
	Juveniles			░	░					░	░	░		1
	Larvae													1
	Eggs													1
Seawater >25.0 ppt	Adults			░	▓	░								1
	Spawning													1
	Juveniles			░	░						░	░	░	2
	Larvae													2
	Eggs													2

Legend: Relative Abundance:

☐ = Not Present
☐ = Rare
░ = Common
▓ = Abundant
█ = Highly Abundant

Data Reliability (R):

1 = Highly Certain
2 = Moderately Certain
3 = Reasonable Inference

Adults were defined as reproductively mature individuals, juveniles as immature but otherwise similar to adults, and spawning adults as those releasing eggs and sperm. There were a few exceptions to these defined life stages, such as mating in blue crab, and parturition in cownose ray. These exceptions are discussed in the *Life History Notes* section of this report, pp. 13-16.

For well-studied species such as striped bass, quantitative data were used to estimate abundance levels. For many species, however, reliable quantitative data were limited. Therefore, regional and local experts were consulted to estimate relative abundances based on the above criteria. Several reference or "guide" species with abundance levels corresponding to the above criteria were identified for each estuary. These guide species typified fishes and invertebrates belonging to a particular life mode (e.g., pelagic, demersal) or occupying similar habitats. Once guide species were selected, other species were then placed into the appropriate abundance categories (not present, rare, common, abundant, highly abundant) relative to the guide species. These data represent relative abundance levels within a specific estuary only; relative abundance levels across Mid-Atlantic estuaries could not be determined.

In some cases, the final level of abundance assigned to a species was determined by asking regional and local biologists for expert opinions based on their knowledge of individual species within an estuary. This effort complemented quantitative studies and greatly increased reliability of abundance information. The quality of relative abundance information varied between estuaries as well as species. As a result, temporal resolution was greater in well-studied estuaries. Nevertheless, the relative abundance data shown in the data summaries are the best that could be synthesized from agency reports, academic studies, and expert reviews.

Data Verification. Approximately two years were required to develop the 1342 data sheets (Figure 4) and consult with regional and local experts for the 22 estuaries studied. Nearly all of the data sheets were carefully reviewed during consultations or by mail. These consultations complemented the literature and published data sets compiled by NOAA. One hundred twenty scientists and managers at fifty institutions were consulted, and their names and affiliations are listed in Appendix 3. Local experts were especially helpful in providing estuary/species-specific information. They also provided additional references and contacts, and identified additional species to be included in the ELMR data base.

Results

Presence/Absence of ELMR Species in Mid-Atlantic Estuaries. Table 3 (pp. 8-9) was developed to readily convey the occurrence of each of the 61 ELMR species in each of the 22 Mid-Atlantic estuaries. This table depicts the highest relative abundance of the adult or juvenile life stage of each species, in any month, in any salinity zone within each estuary. The spawning, egg, and larval life stage categories are not considered. This table also suggests the zoogeographic distribution of species among Mid-Atlantic estuaries.

Data Summaries. The information compiled for each species and each estuary (1342 data sheets) was organized in three data summaries (pp. 19-190). Tables 4 and 5 provide graphic presentations of the spatial and temporal distribution and relative abundance by life stage for each species and estuary. The information shown represents the usual spatial and temporal distribution of a species in a particular estuary.

Spatial distribution and relative abundance. Table 4 (pp. 21-65) summarizes the distribution and relative abundance for each species by life stage, in each estuary by salinity zone. This table combines data over the twelve months, showing the highest level of abundance during the year for each life stage by salinity zone.

Temporal distribution. Table 5 (pp. 67-155) summarizes the temporal distribution of each species by month and life stage for each estuary. This table combines data over the three salinity zones, showing the highest level of abundance for each stage by month.

Seasonal Comparisons. To examine general seasonal abundance patterns, the numbers of species ranked as "common" or greater were counted by month and by salinity zone for adults, juveniles, and larvae. In Figure 5, the numbers of species were plotted by estuary. In Figure 6, the numbers of species were averaged across estuaries and plotted by month. Although these summaries are not statistical analyses, they do suggest trends in the seasonal distribution of selected species in the estuaries:

- The number of species appears to be higher in some estuaries than in others (Figure 5). However, not all of the 61 species are found throughout the Mid-Atlantic region. For example, Atlantic salmon and Atlantic cod occur only in the northernmost portion of the region.

- The numbers of species appears to be lowest in the tidal fresh zone (Figures 5 and 6). However, this is partially due to the fact that the selected ELMR species are primarily estuarine, not freshwater species. Also, there may be fewer published studies of the tidal fresh zones of many estuaries.

- Estuarine utilization by adults, juveniles, and larvae is highest in the summer, and lowest in the winter (Figure 6).

- The number of species present as larvae in the mixing and seawater zones is highest in June and July (Figure 6).

Data Content and Quality

An important aspect of the ELMR program, especially since it is based primarily on published and unpublished literature and consultations, is to determine the quality of available data. For many species, gear selectivity, difficulty in identifying larvae, and difficulty in sampling various habitats has limited the amount of reliable information. Therefore, a deliberate effort was made to assess data reliability so that the data base could be used appropriately.

Estimates of the reliability of the distribution and abundance information organized by species, life stage, and estuary are presented in Table 6 (pp. 157-190) of the *Data Summary Tables* section. Data reliability was classified using the following categories:

- Highly certain: considerable sampling data available. Distribution, behavior, and preferred habitats well documented within an estuary.

- Moderately certain: some sampling data available for an estuary. Distribution, preferred habitat, and behavior well documented in similar estuaries.

- Reasonable inference: little or no sampling data available. Information on distributions, ecology, and preferred habitats documented in similar estuaries.

The quality and quantity of available data vary by species, life stage, and estuary. For example, a large amount of information is available on blue crab because they are highly valued both commercially and recreationally. For most species, the least amount of information and poorest quality of data occur for the spawning, egg, and larval life stages. Except for a few species (e.g., blue crab), little data has been generated on particular habitat preferences and environmental tolerances. This is particularly true for the smaller forage and/or non-commercial fishes and invertebrates. Gear selectivity, inability to correctly identify larval stages, and difficulty in sampling various habitats limits the development and reliability of this information. In addition, life history data are lacking on some of the commercially important sciaenid and pelagic species.

Data reliability was also based on experimental design and whether the studies were relatively recent. In the case of limited studies, information was occasionally inferred. An opportunity exists to refine the data presented based on additional reviews.

Given that the amount and quality of available information varies by species, by life stage, between estuaries, and even within an estuary, considerable scientific judgment is required to derive or infer spatial and temporal distributions from existing data and available literature. Unfortunately, even the most informed judgment is far from perfect due to the complexity of estuarine systems. Consequently, information on the level of certainty associated with each data element must be presented when synthesizing multiple data sets (Table 6). Appendices 2, 3, and 4 provide a complete summary of the personal communications and primary references used so that readers can track and obtain additional information efficiently.

Variability in Space and Time. Species data were organized according to the salinity zone boundaries developed for each estuary in the NEI data atlas-Volume 1 (NOAA 1985). However, division of an estuary on the basis of salinity is highly variable due to the many interacting factors that affect salinity, such as variations in freshwater inflow, wind, and tides. To compile information on species distribution according to these zones, it is assumed that if a particular salinity zone expands or contracts, the distribution of a mobile species in that zone will correspond to the shift. For example, if increased freshwater inflow shifts the tidal fresh zone further down the estuary, the distribution of a species confined to that zone increases to include the new area. If a species exhibits a wide range of salinity tolerance, a shift may or may not occur. The placement of species in a salinity zone was ultimately determined by where they have been observed or captured.

Species temporal distributions are often dependent on annual climatic conditions and water currents. Monthly distributional patterns were derived based on the consistent presence of a life stage within a particular month. If a species is only present in an estuary in unusual years (e.g., drought), it was not portrayed as part of that species' spatial or temporal distribution. However, if a species is usually there, even during a restricted time period, it was considered present for the specific month(s). Greater temporal resolution, such as on a biweekly rather than on a monthly basis, was not feasible.

Table 3. Presence/absence of ELMR species in Mid-Atlantic estuaries. Symbols represent the highest relative abundance of adults or juveniles of a species, in any salinity zone, in any month, within each estuary.

Species	Estuary																					
	Waquoit Bay	Buzzards Bay	Narragansett Bay	Long Island Sound	Connecticut River	Gardiners Bay	Great South Bay	Hudson River/Raritan Bay	Barnegat Bay	New Jersey Inland Bays	Delaware Bay	Delaware Inland Bays	Chincoteague Bay	Chesapeake Bay mainstem	Chester River	Choptank River	Patuxent River	Potomac River	Tangier/Pocomoke Sound	Rappahannock River	York River	James River
Blue mussel	√	●	○	○	○	○	○	◉	○	○	○	○	◉	◉						○	○	○
Bay scallop	◉	◉	○	√	√	○	√					√	√									
American oyster	√	○	○	◉	◉	○	√	√	√	√	●	√	○	○	○	○	○	○	○	◉	○	◉
Northern quahog	●	●	●	◉	◉	◉	●	◉	◉	◉	●	●	●	○						○	◉	◉
Softshell clam	◉	◉	○	○	○	○	○	◉	○	√	◉	√		√	○	○	○	○	○	○	√	√
Brown shrimp						√		√			√	√	○	√				√	√	√	√	√
Daggerblade grass shrimp	◉	●	●	◉	◉	◉	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Sevenspine bay shrimp	●	●	◉	●	◉	◉	●	◉	●	●	◉	●	●	○	○	○	○	○	○	○	○	○
American lobster	○	◉	◉	●	○	○	√	○			○	√		√								
Blue crab	○	○	○	○	○	○	◉	○	●	●	◉	●	●	●	●	●	●	●	●	●	●	●
Skates	√	◉	◉	●	○	○	○	○	○	○	○	○	√	○								
Atlantic stingray				√			√							√						√	√	√
Cownose ray		√	√	√		√	√	√	√	√	√	√	√	◉	○	○	○	○	○	○	○	○
Shortnose sturgeon			√	○	√			○			√											
Atlantic sturgeon		√	√	√	○	○	√	○			√	√		√				√	√	√	√	√
American eel	◉	◉	◉	◉	◉	○	○	◉	○	○	◉	○	●	◉	○	○	○	○	○	○	○	○
Blueback herring	○	○	○	●	●	○	○	●	○	○	◉	√	○	◉	○	○	○	◉	◉	○	○	○
Alewife	○	○	○	●	●	○	○	●	◉	◉	◉	√	√	◉	○	○	○	◉	◉	○	○	○
American shad	√	√	√	◉	●	○	○	●	√	√	◉	√		○	○	○	√	○	○	○	○	○
Atlantic menhaden	○	●	◉	●	◉	◉	◉	◉	◉	◉	◉	◉	◉	●	●	●	●	●	◉	●	●	●
Atlantic herring	√	○	◉	◉	√	○	◉	○	○	○	○	√	√	○						√	√	√
Bay anchovy	√	◉	◉	◉	●	●	●	●	◉	◉	●	●	●	●	●	●	●	●	●	●	●	●
Channel catfish			√	○	◉			√	√	na	○		√	○	○	○	○	○	○	○	○	○
Rainbow smelt	○	○	○	○	○	○		√														
Atlantic salmon				√	○	√	√															
Atlantic cod	√	○	√	√		√																
Haddock		√	√	√		√																
Atlantic tomcod	○	○	○	◉	◉	○	○	◉														
Pollock	○	√	√	○		√	○	√	√	√	√											
Red hake		○	○	◉	○	√	√	○	√	√	○	√	√	○						√	√	√
Oyster toadfish	○	○	○	○	√	○	◉	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○

Relative abundance:

● - Highly abundant ◉ - Abundant ○ - Common √ - Rare Blank - Not present na - No data available

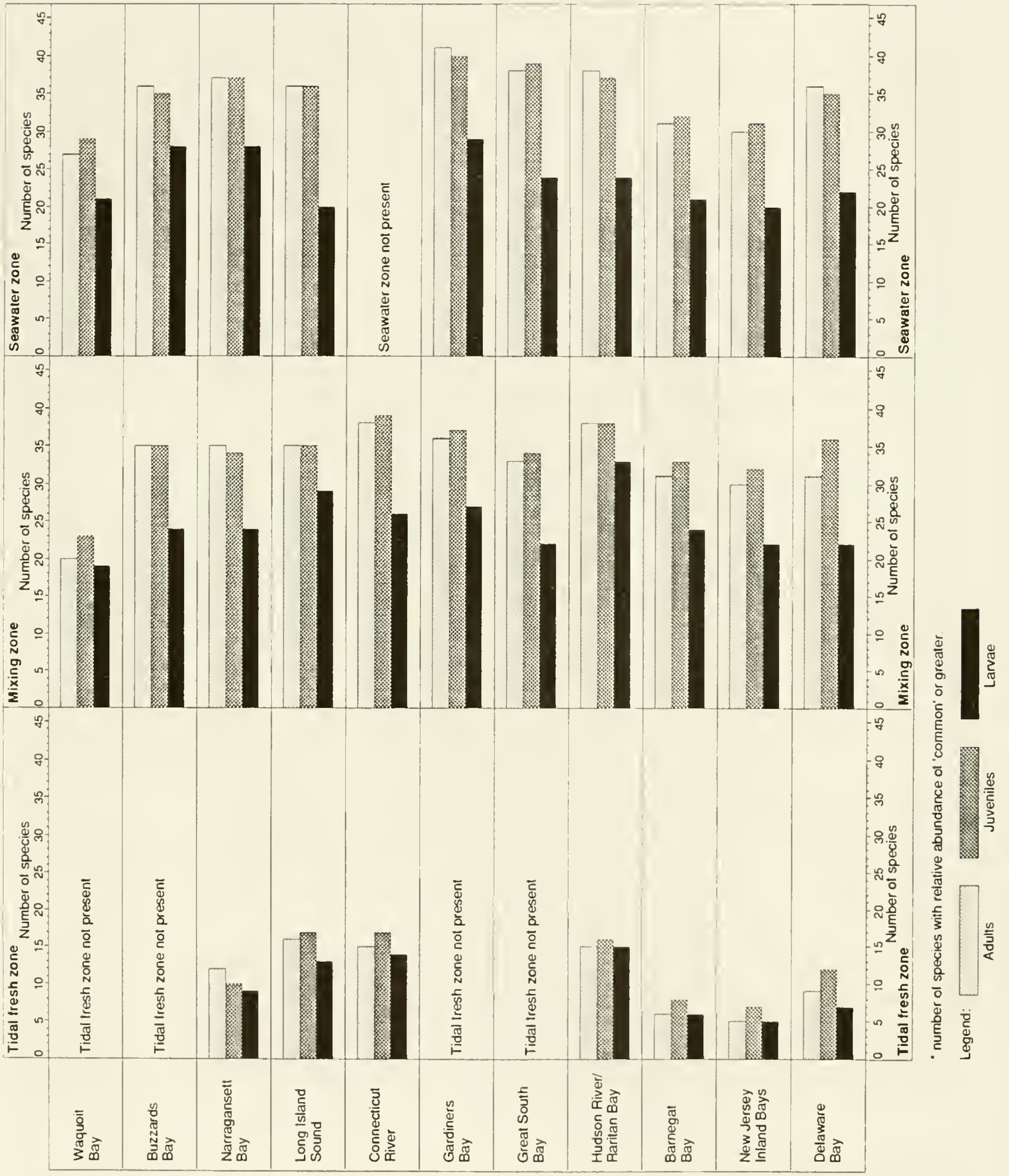
Table 3, continued. Presence/absence of ELMR species in Mid-Atlantic estuaries.

Species	Waquoit Bay	Buzzards Bay	Narragansett Bay	Long Island Sound	Connecticut River	Gardiners Bay	Great South Bay	Hudson River/Raritan Bay	Barnegat Bay	New Jersey Inland Bays	Delaware Bay	Delaware Inland Bays	Chincoteague Bay	Chesapeake Bay mainstem	Chester River	Choptank River	Patuxent River	Potomac River	Tangier/Pocomoke Sound	Rappahannock River	York River	James River
	Estuary																					
Sheepshead minnow	○	○	√	○	○	○	◉	○	○	○	○	○	○	◉	◉	◉	◉	◉	◉	◉	◉	◉
Killifishes	●	◉	◉	◉	◉	◉	●	◉	◉	◉	●	◉	◉	●	●	●	●	●	●	●	●	●
Silversides	●	●	●	●	◉	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Northern pipefish	○	○	○	○	○	○	◉	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
Northern searobin	○	○	○	○	○	○	○	○	○	○	○	○	○	◉		√	√	√	√	√	√	√
White perch	√	○	◉	●	●	○	○	●	○	◉	◉	√	○	◉	◉	◉	◉	◉	○	◉	◉	◉
Striped bass	○	○	○	◉	◉	○	◉	◉	√	√	○	○		○	○	○	◉	◉	○	○	○	○
Black sea bass	√	○	○	○		○	○	√	◉	◉	○	○	○	○	√	√	√	√	○	√	√	○
Yellow perch		√	○	◉	◉			○	○	◉	○	√		○	○	○	○	○	√	○	○	○
Bluefish	○	◉	◉	◉	◉	◉	◉	◉	◉	◉	◉	○	○	◉	○	○	○	◉	◉	◉	◉	◉
Pinfish			√					√		√	√	√	√	○								○
Scup	○	●	●	●	√	◉	○	◉	○	○	○	○	√	◉					√		√	√
Spotted seatrout									√	√	√	√	√	○	○	○	○	○	○	○	○	○
Weakfish	√	○	○	◉	√	◉	○	◉	○	○	◉	○	◉	○	○	○	○	○	○	○	○	○
Spot		√	○	√	√	√	○	◉	●	●	◉	●	◉	◉	○	◉	○	○	◉	◉	◉	◉
Northern kingfish	√	√	√	√		○	○	○	√	√	√	○	√	√			√	√	√	√	√	√
Atlantic croaker						√		√	√	√	○	○	○	◉	○	○	○	○	○	◉	◉	◉
Black drum			√					√	√	√	√	√		○	√	○	√	○	○	○	○	○
Red drum									√	√	√	√		○	√	√	√	○	○	○	○	○
Mullets	○	√	√	√	√	○	○	○	○	○	○	○	○	○			√	√	√	√	√	√
Tautog	◉	◉	○	○	○	○	◉	◉	○	○	○	√	√	○	√	√	√	√	○	○	○	○
Cunner	●	●	○	○	○	○	◉	√	○	○	√		√									
American sand lance	○	◉	○	◉	○	◉	○	◉	○	○	√		√									
Gobies	√	√	○	○	○	○	○	○	○	○	○	◉	○	◉	◉	◉	◉	◉	◉	◉	◉	◉
Atlantic mackerel	○	○	○	○		○	○	○	√	√	√	√		√						√	√	√
Butterfish	○	●	◉	●	○	○	○	○	○	○	○	○		○		√	√	√	√	√	○	○
Summer flounder	○	○	○	√	○	○	○	○	○	○	○	●	●	○	○	○	○	○	○	○	○	○
Windowpane flounder	○	◉	◉	●	●	○	◉	○	●	●	◉	○	○	○					○		√	√
Winter flounder	●	●	◉	●	●	◉	●	◉	◉	○	○	○	○	√	√	√	√	√	√	√	√	√
Hogchoker	√	○	○	○	◉	○	○	◉	◉	◉	●	●	○	●	●	●	●	●	●	●	●	●

Relative abundance:

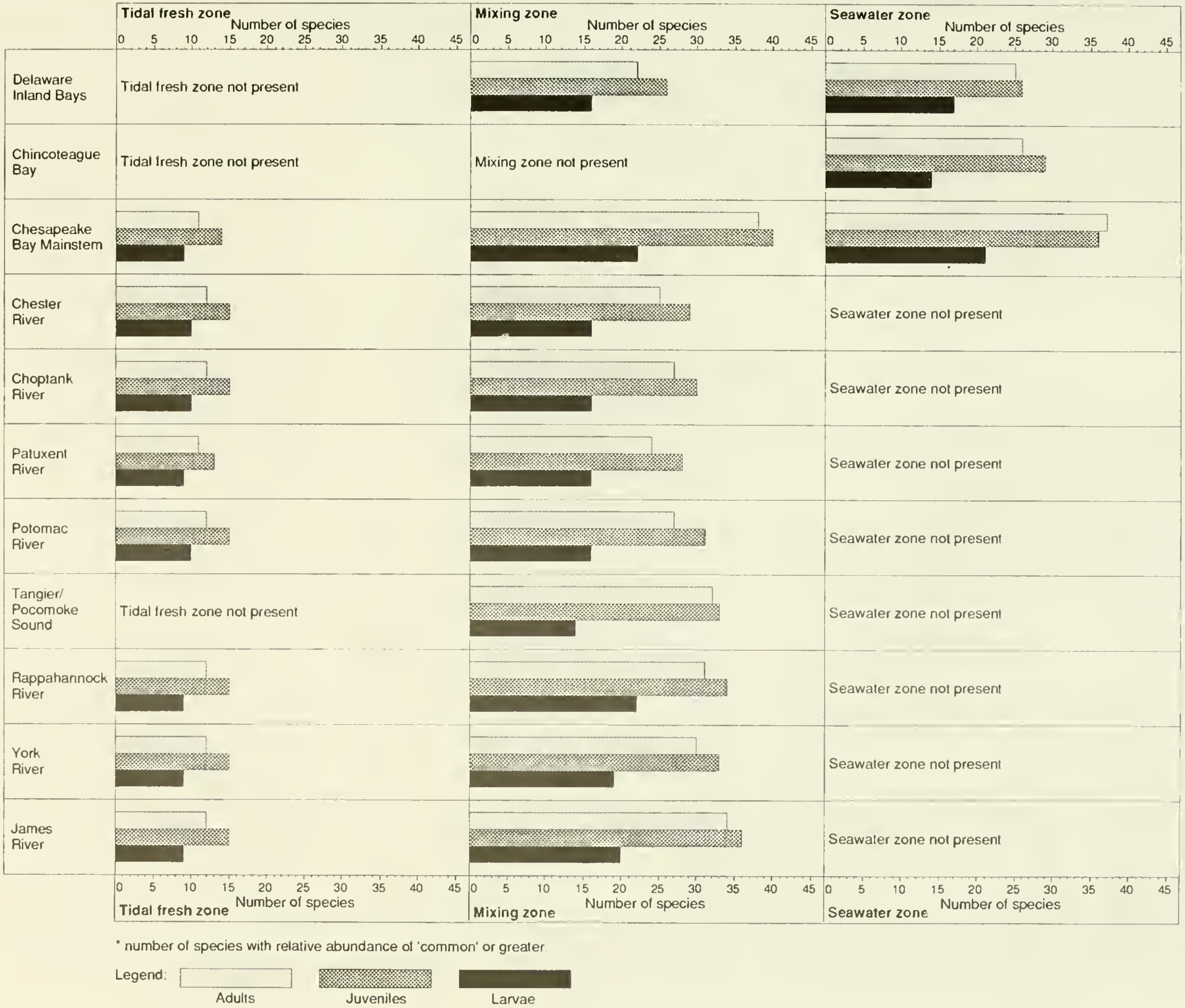
● - Highly abundant ◉ - Abundant ○ - Common √ - Rare Blank - Not present na - No data available

Figure 5. Numbers of ELMR species* in Mid-Atlantic estuaries, by estuary, salinity zone, and lifestage.



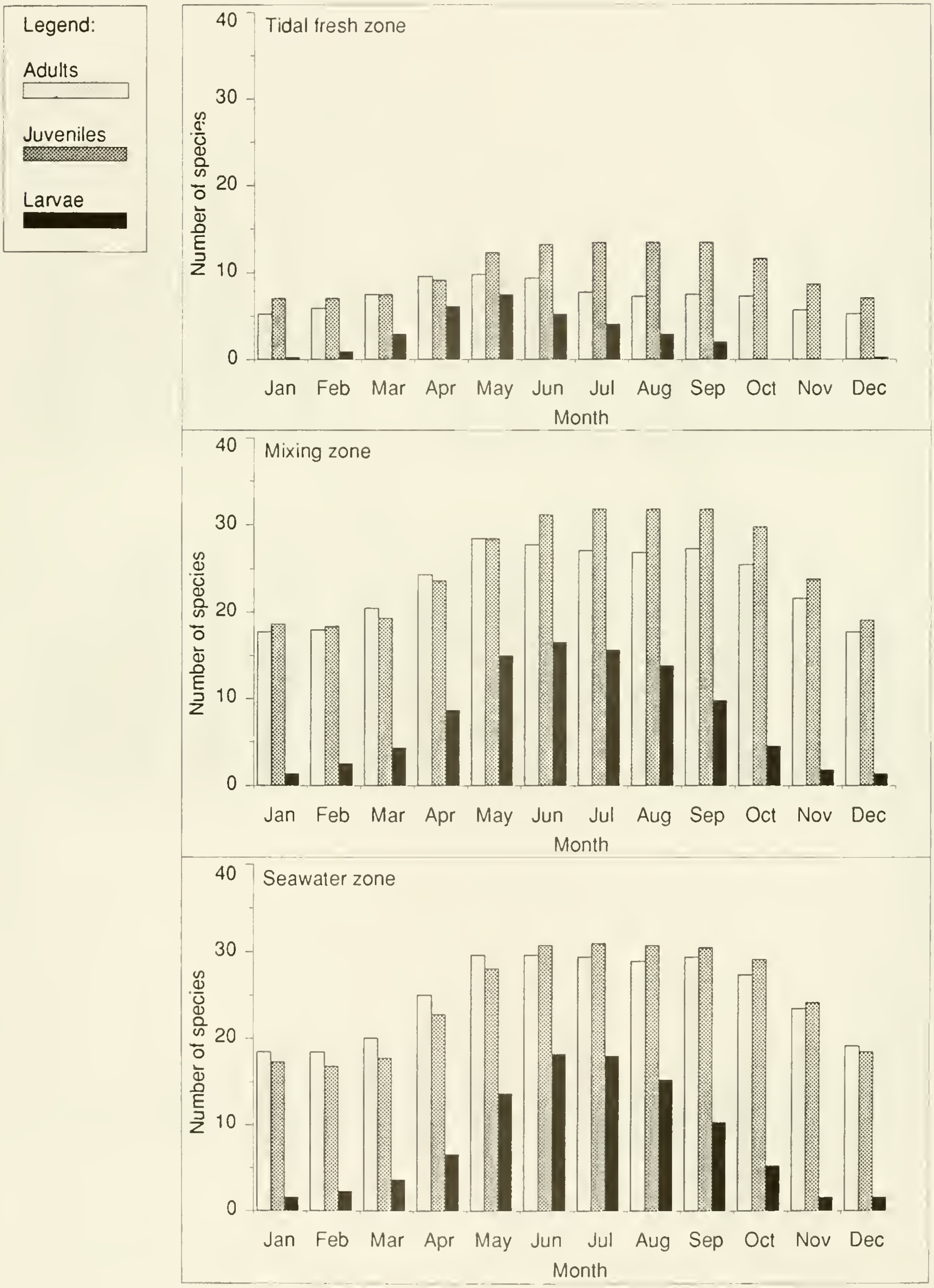
* number of species with relative abundance of 'common' or greater.

Figure 5, continued. Numbers of ELMR species* in Mid-Atlantic estuaries, by estuary, salinity zone, and lifestage.



* number of species with relative abundance of 'common' or greater.

Figure 6. Number of ELMR species* in Mid-Atlantic estuaries, by salinity zone, life stage, and month.



* number of species with relative abundance of 'common' or greater, averaged across estuaries.

Life History Notes. Because of the complex life histories of some species, the following discussion clarifies and supplements information presented in the data summary tables. These life history notes identify cases in which the ELMR program has considered alternate life stages, cases in which two or more species are considered as a single unit, and other pertinent life history information.

For the majority of species considered in this report, growth and development involves a direct progression through several distinct life stages. Accordingly, the ELMR program has compiled information based on five "typical" life stages: adult (A), spawning adult (S), juvenile (J), larva (L), and egg (E). Adults were defined as reproductively mature individuals, while juveniles were defined as immature but otherwise similar to adults in appearance. Species with a larval stage typically undergo metamorphosis to the juvenile stage, hence larvae usually differ from juveniles and adults in form and appearance. In addition, most species rely on external fertilization via spawning, by which gametes combine outside the body after being released by males and/or females.

However, some species depart from this typical life stage scheme in that spawning is replaced by mating (M), i.e. the transfer of gametes internally between male and female. This reproductive mode differs from spawning in that it often involves specialized copulatory organs (e.g., pelvic claspers in skates) and does not always result in the immediate fertilization of eggs (e.g., spermatophore retention in American lobster and blue crab). Furthermore, two species (Atlantic stingray and cownose ray) are live-bearers and thus distinguished by a parturition (P) stage, but no egg or larval stage. In addition, egg and/or larval stages are not applicable for certain species because the stage(s) is either absent or better defined by the presence of gravid females.

Molluscs. Sessile molluscs, such as clams and oysters, usually have a patchy rather than a uniform distribution. Therefore, the ELMR framework may identify the salinity zones of colonization, but also may overestimate the areal distribution of these organisms. Specific areas of an estuary may contain acceptable salinity regimes, but suitable bottom habitat for colonization may not exist. Specific habitat requirements and life history characteristics of several mollusc species are provided below.

- Blue mussel: Not common south of Chesapeake Bay. Occurs in littoral and sublittoral habitat, requires at least some hard substrate for attachment, and may form dense beds.

- Bay scallop: Often associated with eelgrass beds, sandy substrate, relatively high salinities, and depths < 2 m.

- American oyster: Also known as "eastern oyster" (Turgeon et al. 1988). Oysters are typically subtidal in Mid-Atlantic estuaries, and they usually attach to firm substrate such as oyster shell. Oyster bars require tidal currents to import food, flush wastes, and prevent sedimentation.

- Northern quahog: Also known as "hard clam" (Turgeon et al. 1988, Nelson et al. 1992). Two species of *Mercenaria* occur in U.S. coastal waters, but the northern quahog (*Mercenaria mercenaria*) is by far the predominant species in the Mid-Atlantic region. They are generally found in intertidal and subtidal waters to 15 m, and typically in salinities above 20 ppt. Substrate preferences may vary, but they are often more common in sand than in mud. The southern quahog (*Mercenaria campechiensis*) is not common north of Cape Hatteras, and is generally found in deeper, higher salinity waters.

- Softshell clam: Substrate preferences may vary, but they are often more common in sand than in mud. Not common south of Chesapeake Bay.

Crustaceans. Some life history characteristics of ELMR crustacean species are provided below.

- Brown shrimp: Spawning (S) for this Penaeid shrimp is considered a singular event involving pairing of males and females, egg fertilization, and egg release. Postlarvae (L) and juveniles (J) are the main life stages utilizing the estuaries. Adults generally move to nearshore spawning grounds, where spawning, egg development, and most of the larval development occur. This species is generally not as abundant in Mid-Atlantic estuaries as it is in the southeast U.S. and Gulf of Mexico.

- Daggerblade grass shrimp and sevenspine bay shrimp: Soon after pairing with males, female Caridean shrimps fertilize and extrude eggs onto their pleopods where they are held for up to two months until hatching as larvae. Therefore, spawning (S) for these species is defined as the period of egg fertilization and extrusion. The egg (E) stage is defined as the period when gravid (i.e., "berried") females are generally encountered. Daggerblade grass shrimp (*Palaemonetes pugio*) is closely related to several other species that also occur in Mid-Atlantic estuaries (Anderson 1985, Williams et al. 1988). Riverine grass shrimp (*P. paludosus*) is a primarily freshwater species that can occur in the upper reaches of estuaries. Marsh grass shrimp (*P. vulgaris*) and brackish grass shrimp (*P. intermedius*) typically occur in higher salinities than *P. pugio*.

- American lobster: After mating, the female holds the spermatophore for about one year before fertilizing the eggs and extruding them onto her pleopods for brooding (berried female). The mating period is not identified by the ELMR Program; instead, spawning (S) for this species is defined as the period of egg fertilization and extrusion. The egg (E) stage is defined as the period when berried females are generally encountered. Females may brood the eggs for up to 11 months before they hatch as larvae.

- Blue crab: Life stages considered are adults (A), mating (M), juveniles (J), larvae (L), and eggs(E). The ELMR Program identifies the mating (M) period, but not the spawning period. Mating usually takes place in the low salinities of the upper reaches of estuaries. After mating, females move to higher salinities, while males often remain in the upper reaches of the estuary. The female holds the spermatophore for up to two years before fertilizing the eggs and extruding them onto her pleopods for brooding (sponge female phase). The egg stage is defined as the period when sponge females are generally encountered. Females typically brood the eggs for 1-2 weeks before they hatch as larvae. Development through the late zoeal stages occurs offshore, then megalopae are transported back into the estuary and disperse throughout the salinity zones. Zoea and megalopae are considered as larvae (L). As they approach maturity, blue crabs seek lower salinities.

Fishes. Compiling information by salinity zone uses a single fundamental habitat parameter. However, a combination of habitat characteristics, such as bottom type, water temperature, and bathymetry, would more accurately describe the spatial and temporal distributions of many species. Some life history characteristics of ELMR fish species are provided below.

- Skates: Life stages considered are adults (A), mating (M), juveniles (J), and eggs(E). Following mating, eggs are extruded in leather-like, horny cases for incubation. Hatching occurs several months after egg extrusion, and the egg stage refers to the period from egg extrusion to hatching. Upon hatching, young skates are considered juveniles, therefore the ELMR Program does not identify a larval stage for these species. *Raja* species in Mid-Atlantic estuaries include *R. eglanteria* (clearnose skate), *R. erinacea* (little skate), *R. ocellata* (winter skate), and *R. laevis* (barndoor skate).

- Atlantic stingray and cownose ray: Life stages considered are adults (A), mating (M), juveniles (J), and parturition (P). Mating refers to the period of copulation/internal fertilization. Both species are believed to be ovoviviparous, i.e. they incubate eggs internally (without maternal nourishment) and liberate live young (parturition). Hence, the ELMR Program identifies the parturition stage, but does not identify egg or larval stages for these species. Cownose rays are known to form large schools that enter estuaries to feed.

- Shortnose and Atlantic sturgeons: Shortnose sturgeon is considered an endangered species throughout its range, and Atlantic sturgeon has been listed as a protected species by the States of New Jersey, Connecticut, and Rhode Island (Johnson 1987, USFWS 1993). Both species are anadromous, occur primarily in large river systems, are slow growing, and long-lived. Spawning may occur in fresh or brackish water, and presumably does not occur every year for individual females. Atlantic sturgeon eggs are demersal and adhesive, and larvae drift downstream. Juvenile Atlantic sturgeon remain in fresh or brackish water for their first summer, then migrate seaward.

- American eel: Spawning occurs in the Sargasso Sea, and the pelagic larvae (leptocephali) may spend over a year in marine waters before being transported shoreward. As leptocephali reach the continental shelf, they metamorphose into transparent "glass eels". As glass eels migrate into estuaries and fresh water, they develop pigment and are considered "elvers", which then grow into "yellow eels". Yellow eels inhabit estuarine and fresh waters for years before maturing into "silver eels" and migrating seaward (Fahay 1978). The ELMR program considers silver eels as adults (A), elvers and yellow eels as juveniles (J), and glass eels and leptocephali as larvae (L). Although the egg (E) stage is identified, it is not found in estuarine waters.

- Blueback herring and alewife: Spawning occurs in the spring, primarily in fresh water above and below head-of-tide. Alewives, however, generally enter rivers earlier, ascend farther, and spawn in slower moving water than do blueback herring. Adults of both species typically move seaward after spawning. These two species can be difficult to distinguish, and they are often referred to collectively as "river herring".

- American shad: An anadromous species with a fairly strong natal homing tendency. Adults spawn in freshwater rivers and typically die afterwards. Juveniles use low salinity estuarine waters as a nursery area, then move seaward in the fall.

- Atlantic menhaden: Spawning occurs in the seawater zones of many Mid-Atlantic estuaries. Larvae move inshore, and juveniles use estuaries as a nursery area.

- Atlantic herring: Generally more abundant in the Gulf of Maine than in the Mid-Atlantic region. Spawning is in coastal oceanic waters primarily north of Cape Cod, and larvae are transported shoreward.

- Bay anchovy: All life stages occur in estuaries, although adults may move offshore. The bay anchovy is a key forage species that is one of the most abundant fishes in Mid-Atlantic estuarine waters, but it is not common north of Cape Cod.

- Channel catfish: A freshwater species that is also important in low-salinity riverine estuaries, such as the Chesapeake Bay tributaries.

- Rainbow smelt: Not common south of New York. Spawning occurs primarily in fresh water, and there are many landlocked freshwater populations.

- Atlantic salmon: Spawning occurs in cold freshwater streams. Restoration efforts are underway in the Connecticut River watershed and elsewhere in New England to re-establish self-sustaining runs.

- Gadids (Atlantic cod, haddock, pollock, and Atlantic tomcod): Atlantic cod, haddock, and pollock are generally more abundant in the Gulf of Maine than in the Mid-Atlantic region. Atlantic tomcod is not common south of New York.

- Oyster toadfish: An estuarine resident, and a bottom predator of molluscs and crustaceans. Adhesive eggs are quite large (5 mm diameter).

- Sheepshead minnow: An estuarine resident, and all life stages are euryhaline and eurythermal. Tends to prefer open bottom to heavily vegetated areas.

- Killifishes: For the purposes of this report, the ELMR Program has compiled information for *Fundulus* species collectively. Major species in Mid-Atlantic estuaries include mummichog (*F. heteroclitus*), striped killifish (*F. majalis*), and banded killifish (*F. diaphanus*). Banded killifish is a primarily freshwater species, but also occurs in tidal fresh and mixing zones of Mid-Atlantic estuaries. Mummichog and striped killifish are euryhaline and are found throughout the estuarine salinity gradient. Less common species include spotfin killifish (*F. luciae*) and bayou killifish (*F. pulvereus*, formerly *F. confluentus*) (Hardy 1978, Lee et al. 1980, Robins et al. 1991). Spotfin killifish is found in higher estuarine salinities, and is generally not abundant. The lower Chesapeake Bay may be the northernmost range of the bayou killifish.

- Silversides: The two *Menidia* species that commonly occur in Mid-Atlantic estuaries are *M. menidia*, Atlantic silverside, and *M. beryllina*, inland silverside (Robins et al. 1991). The Atlantic silverside is generally found in moderate to higher salinity estuarine waters from Florida to Nova Scotia. The inland silverside occurs primarily in low salinity estuarine waters and inland fresh waters, and is not common north of Cape Cod. Although these two species do occur together, they are not generally known to hybridize (Johnson 1975). Silversides are one of the most abundant forage fishes of Mid-Atlantic estuaries, and they often form schools near the surface in shallow waters. Spawning behavior is periodic and may be affected by tidal cycle, lunar phase, and daylight, but most silversides die after their first spawning.

- Northern pipefish: Life stages considered are adults (A), mating (M), juveniles (J), and larvae (L). During mating, the female deposits eggs into the males' brood pouch for fertilization and incubation. Young pipefish are considered larvae from the time of hatching (about 1-2 weeks after mating) until they reach a length of approximately 20 mm. The ELMR Program does not identify an egg stage for this species.

- White perch: Spawning occurs in fresh water above and below head-of-tide, and in low salinity estuarine waters. Eggs are demersal. Juveniles and adults typically remain in the estuary and do not migrate to sea. Landlocked freshwater populations also exist.

- Striped bass: Spawning occurs in the spring in freshwater rivers, and in low-salinity tidal waters where there is sufficient current. Eggs are non-adhesive and semi-buoyant. Juveniles tend to form schools and remain in estuarine waters. Adults may move offshore, or stay within the estuary.

- Yellow perch: A primarily freshwater species that is also native to the low salinity tidal reaches of many Mid-Atlantic estuaries, and can be considered semi-anadromous. Adults ascend freshwater tributaries in early spring for spawning.

- Bluefish: Spawning, egg and larval development occur offshore. Juveniles and adults enter estuaries to feed in the spring and summer, then move out to sea and southward in the winter. The bluefish is a primarily visual predator, and often schools.

- Pinfish: Juveniles are the predominant life stage within estuaries. Spawning and eggs are typically found offshore. Larvae are transported to inlets, but usually attain juvenile size before they enter bays. Subadults and adults may remain in some bays before migrating offshore for spawning. Juveniles and adults are euryhaline, but usually more abundant in higher salinities.

- Sciaenids (spotted seatrout, weakfish, spot, northern kingfish, Atlantic croaker, black drum, and red drum): Most sciaenids move to nearshore or offshore waters for spawning, although some may spawn in passes. Larvae may be transported toward estuaries, but typically attain juvenile size before they enter. Juveniles develop in the nursery habitats of the bays, then migrate out as subadults. Since some of these species have rather long life spans, several years may be spent in the estuaries as juveniles. As temperatures drop in the winter, they move into deeper waters. Spotted seatrout, Atlantic croaker, black drum, and red drum are generally more abundant south of the Mid-Atlantic region.

- Mullets: For the purposes of this report, the ELMR program has compiled information for striped mullet (*Mugil cephalus*) and white mullet (*M. curema*) collectively. Both species spawn in marine coastal waters and enter estuaries to feed, and both species are generally more abundant south of Cape Hatteras than in the Mid-Atlantic region. Striped mullet ascend into lower salinities more often than do white mullet, and striped mullet are generally more abundant in Mid-Atlantic estuaries than are white mullet.

- Tautog and cunner: Spawning occurs in the seawater zones of Mid-Atlantic estuaries, and eggs are buoyant. Juveniles remain in estuaries through the winter, but may become inactive. Adults are often associated with rocky reefs or mollusc beds.

- American sand lance: Generally more abundant in the northern Mid-Atlantic estuaries. Adults are demersal and may burrow in sandy substrate. May co-occur with the northern sand lance (*Ammodytes dubius*), but *A. dubius* is primarily found in deeper offshore waters (Nizinski et al. 1990, Robins et al. 1991).

- Gobies: For the purposes of this report, information on *Gobiosoma* species has been compiled collectively. Three species of *Gobiosoma* occur in Mid-Atlantic estuaries: naked goby (*G. bosci*), seaboard goby (*G. ginsburgi*), and code goby (*G. robustum*) (Robins et al. 1991). The naked goby is most abundant in low to moderate salinity waters, and is often associated with oyster reefs or submerged aquatic vegetation. The seaboard goby prefers higher estuarine salinities, and is often found on oyster reefs. The code goby prefers moderate to high salinities, but is relatively scarce in the Mid-Atlantic region.

- Butterfish: Butterfish may spawn in the seawater zones of some estuaries in the summer, but they typically move offshore to overwinter. Generally more common in the northern Mid-Atlantic estuaries than in the southern ones.

- Flounders: As their names suggest, winter flounder enter estuaries primarily in the winter months, whereas summer flounder do so in the spring and summer.

- Hogchoker: Spawning occurs primarily in the mixing zone of estuaries, but juveniles may ascend into tidal fresh waters and even well above the head-of-tide.

Coupling of Estuarine and Marine Ecosystems

Classifying and Comparing Estuaries. Although the qualitative nature of the distribution data precludes statistical comparisons of species abundances among estuaries, comparisons can be made using data on the presence/absence of species in salinity zones. This information, combined with the spatial and temporal distribution data, is the strength of the ELMR data base. Estuaries can be loosely categorized by their physical and chemical characteristics and their associated species assemblages. The relative importance of individual estuaries to specific species may also be determined.

The species found in an estuary are sensitive indicators of both the mean and extreme environmental conditions within that estuary. Estuaries can be classified by the number of species present and by whether the fauna are primarily marine, estuarine, or freshwater. Species assemblages may correlate with physical characteristics, such as substrate, vegetation, areal and temporal characteristics of salinity zones. The information on species presence/absence or other attributes can be used to determine the faunal similarities and differences among estuaries.

A comparison of estuaries and associated species can identify differing factors among those estuaries that might account for shifts in species distribution and relative abundance, helping to define ecological variables controlling species distributions. For example, a species may show differing salinity tolerances among estuaries, suggesting that some other factor, such as temperature, competition, or predation may be regulating its distribution.

Linkages to Marine Ecosystems. Estuaries provide a year-round home to many aquatic species; however, a large number of species use estuaries for specific parts of their life histories and spend the rest offshore. Most of these latter species fall into four general categories: 1) diadromous species, which use estuaries as migration corridors and, in some instances, nursery areas; 2) species that use estuaries for spawning, often at specific salinities; 3) species that spawn in marine waters near the mouths of estuaries and depend on tidal and wind-driven currents to carry eggs, larvae, or early juveniles into estuarine nursery areas;

and 4) species that enter estuaries during certain times of the year to feed on abundant prey. The biological importance of an estuary can be assessed by the intensity with which species use estuarine habitats. Importance can be estimated both by the number of species present as well as the density of specific life stages in estuaries relative to offshore habitats. These data may assist in identifying adverse effects of estuarine degradation on offshore populations.

East Coast of North America Strategic Assessment Project. Development of a diagnostic capability to link estuaries to marine ecosystems is a component of the Division's *East Coast of North America Strategic Assessment Project* (ECNASAP) (NOAA 1991). The ECNASAP is currently under development through two joint pilot projects between NOAA and Canada (ACZISCC 1993). The ECNASAP is defining the major biological, physical, chemical, and economic characteristics of the east coast of North America to address multiple resource use conflicts. The data compiled for the ELMR southeast, Mid-Atlantic, and North Atlantic regions will be integrated into the ECNASAP which includes electronic mapping of the distribution and relative abundance of living marine resources. The study area begins at the head-of-tide in estuaries and encompasses the continental shelf as defined by the 200-m isobath and epipelagic waters. The ELMR distribution and abundance data are the primary source of fish and invertebrate information for USA east coast estuaries. The data will be integrated with the coastal and offshore living resource information to develop a consistent data base on species from the head-of-tide to past the continental shelf. This will enable the development of a capability to define the coupling of estuarine and marine ecosystems based on species' distributions, life history strategies, and physical and hydrological habitat requirements (Monaco and Lowery 1993)

The ECNASAP complements other Federal marine environmental programs, e.g., National Status and Trends (O'Connor 1990), and will support regional environmental assessments of anthropogenic effects on living marine resources. Integration of biological and physical data will significantly improve our ability to identify and define the biological linkages and physical interchanges between estuarine and shelf habitats. As it becomes apparent that the cumulative effects of small alterations in estuaries have a systemic impact on coastal ocean resources, it is more important than ever to compile consistent information on the Nation's estuarine fishes and invertebrates. Although the knowledge available to effectively conserve and manage living resources is limited, the ELMR program provides an important tool for assessing the status of estuarine fauna and examining their relationships with other species and their environment. The ELMR data base provides baseline information on the zoogeography and ecology of estuarine fishes and invertebrates, and identifies gaps in our knowledge of these resources.

Acknowledgments

We thank those individuals that provided information and reviewed the data in this report. Without their efforts a study of this magnitude and complexity would not be possible. In addition, we thank the many other scientists and managers who provided contacts and references. Special thanks are due to Anne M. Lange and Maurice P. Lynch for their comments on this manuscript. The illustrations of weakfish, silversides, and striped bass on the front cover are from Goode (1884).

Literature Cited

ACZISCC (Atlantic Coastal Zone Information Steering Committee of Canada). 1993. East Coast of North America Strategic Assessment Project: Pilot Project Proposal. NOAA/NOS Strategic Environmental Assessments Division, Rockville, MD. 22 p.

Anderson, G. 1985. Species profiles: life histories and environmental requirements of coastal fishes and invertebrates (Gulf of Mexico) - grass shrimp. U.S. Fish Wild. Serv. Biol. Rep. 82(11.35).

Darnell, R.M., R.E. Defenbaugh, and D. Moore. 1983. Northwestern Gulf shelf bio-atlas. Open File Report No. 82-04. U.S. Minerals Management Service, Gulf of Mexico OCS Regional Office. Metairie, LA. 438 p.

Fahay, M.P. 1978. Biological and fisheries data on American eel, *Anguilla rostrata*. NOAA Tech. Rep. NMFS-NEFC-17. 84 p.

Goode, G.B. 1884. The Fisheries and Fishing Industry of the United States. Sec. I, Natural History of Useful Aquatic Animals. U.S. Comm. Fish, Washington, DC. 895 p., 277 pl.

Gunter, G. 1967. Some relationships of estuaries to the fisheries of the Gulf of Mexico. *In* Lauff, G.H. (ed.), Estuaries, pp. 621-638. AAAS Spec. Pub. No. 83. Amer. Assoc. Adv. Sci., Washington, DC. 757 p.

Hardy, J.D., Jr. 1978. Development of Fishes of the Mid-Atlantic Bight, An Atlas of Egg, Larval, and Juvenile Stages. Volume II, Anguillidae through Syngnathidae. U.S. Fish Wildl. Serv., Ofc. Biol. Serv. FWS/OBS-78/12. 458 p.

Johnson, J.E. 1987. Protected Fishes of the United States and Canada. American Fisheries Society, Bethesda, MD. 42 p.

Johnson, M.S. 1975. Biochemical systematics of the Atherinid genus *Menidia*. Copeia 1975(4): 662-691.

Joseph, E.B. 1973. Analysis of a nursery ground (abstract). *In* Pacheco, A.L. (ed.), Proceedings of a workshop on egg, larval, and juvenile stages of fish in Atlantic Coast estuaries, pp. 118-121. NOAA/NMFS Middle Atlantic Coastal Fisheries Center Tech. Pub. No. 1.

Lee, D.S., C.R. Gilbert, C.H. Hocutt, R.E. Jenkins, D.E. McAllister, and J.R. Stauffer, Jr. 1980. Atlas of North American Freshwater Fishes. North Carolina State Museum of Natural History, N.C. Biol. Surv. Pub. No. 1980-12. 867 p.

Mann, K.H. 1982. Ecology of Coastal Waters. Univ. of California Press, Los Angeles, CA. 322 p.

Monaco, M.E. 1986. National Estuarine Inventory: Living Marine Resources Component, Preliminary West Coast Study. ELMR Rep. No. 1. NOAA/NOS Ocean Assessments Division, Rockville, MD. 33 p.

Monaco, M.E., and T.A. Lowery. 1993. Comparative analysis of U.S. east coast estuaries based on fish and invertebrate distributions and estuarine physical and hydrological characteristics (abstract). 12th Biennial International Estuarine Research Federation Conference, November 14-18, 1993, Hilton Head, SC.

Nelson, D.M. (ed.). 1992. Distribution and abundance of fishes and invertebrates in Gulf of Mexico estuaries, Vol. 1: Data summaries. ELMR Rep. No. 10. NOAA/NOS Strategic Environmental Assessments Division, Rockville, MD. 273 p.

Nizinski, M.S., B.B. Collette, and B.B. Washington. 1990. Separation of two species of sand lances, *Ammodytes americanus* and *A. dubius*, in the western North Atlantic. Fish. Bull., U.S. 88(2): 241-255.

NOAA (National Oceanic and Atmospheric Administration). 1985. National Estuarine Inventory: Data Atlas. Volume 1. Physical and Hydrologic Characteristics. NOAA/NOS Strategic Assessment Branch, Rockville, MD. 103 p.

NOAA (National Oceanic and Atmospheric Administration). 1988. Bering, Chukchi, and Beaufort Seas Strategic Assessment: Data Atlas. NOAA/NOS Strategic Assessment Branch, Rockville, MD. 135 p.

NOAA (National Oceanic and Atmospheric Administration). 1991. Prospectus for the East Coast of North America Strategic Assessment Project: Biogeographic Characterization Component. NOAA/NOS Strategic Environmental Assessments Div., Rockville, MD. 17 p.

O'Connor, T.P. 1990. Coastal Environmental Quality in the United States, 1990: Chemical Contamination in Sediment and Tissues. NOAA/NOS Ocean Assessments Division, Rockville, MD. 34 p.

Robins, C.R., R.M. Bailey, C.E. Bond, J.R. Brooker, E.A. Lachner, R.N. Lea, and W.B. Scott. 1991. Common and Scientific Names of Fishes from the United States and Canada, Fifth Edition. Am. Fish. Soc. Spec. Pub. 20. American Fisheries Society, Bethesda, MD. 183 p.

Turgeon, D.D., A.E. Bogan, E.V. Coan, W.K. Emerson, W.G. Lynons, W.L. Pratt, C.F.E. Roper, A. Scheltema, F.G. Thompson, and J.D. Williams. 1988. Common and Scientific Names of Aquatic Invertebrates from the United States and Canada: Mollusks. Am. Fish. Soc. Spec. Pub. 16. American Fisheries Society, Bethesda, MD. 277 p.

USFWS (U.S. Fish and Wildlife Service). 1993. Endangered and threatened wildlife. Code of Federal Regulations, 50 CFR 17.11.

Weinstein, M.P. 1979. Shallow marsh habitats as primary nurseries for fishes and shellfish. Cape Fear River, North Carolina. Fish. Bull., U. S. 77: 339-357.

Williams, A.B., L.G. Abele, D.L. Felder, H.H. Hobbs, Jr., R.B. Manning, P.A. McLaughlin, and I. Pérez-Farfante. 1988. Common and Scientific Names of Aquatic Invertebrates from the United States and Canada: Decapod Crustaceans. Am. Fish. Soc. Spec. Pub. 17. American Fisheries Society, Bethesda, MD. 77 p.

Data Summary Tables

Table 4. Spatial distribution and relative abundance

Table 5. Temporal distribution and relative abundance

Table 6. Data reliability

In each data summary table, species are listed in a phylogenetic order, as in Table 2, p. 4. Estuaries are listed in a north to south order, as in Table 1, p. 4. At the beginning of each data summary is an index table showing the page location of each species and estuary in the data summary.

Table 4. Spatial distribution and relative abundance

Index to Table 4. Page location of spatial distribution table for each species and estuary.

	Waquoit Bay Buzzards Bay Narragansett Bay Long Island Sound Connecticut River Gardiners Bay	Great South Bay Hudson River/Raritan Bay Barnegat Bay New Jersey Inland Bays Delaware Bay Delaware Inland Bays	Chincoteague Bay Chesapeake Bay mainstem Chester River Choptank River Patuxent River Potomac River	Tangier/Pocomoke Sound Rappahannock River York River James River
Blue mussel (*Mytilus edulis*) Bay scallop (*Argopecten irradians*) American oyster (*Crassostrea virginica*) Northern quahog (*Mercenaria mercenaria*) Softshell clam (*Mya arenaria*) Brown shrimp (*Penaeus aztecus*)	p. 22	p. 23	p. 24	p. 25
Daggerblade grass shrimp (*Palaemonetes pugio*) Sevenspine bay shrimp (*Crangon septemspinosa*) American lobster (*Homarus americanus*) Blue crab (*Callinectes sapidus*) Skates (*Raja* species)	p. 26	p. 27	p. 28	p. 29
Atlantic stingray (*Dasyatis sabina*) Cownose ray (*Rhinoptera bonasus*) Shortnose sturgeon (*Acipenser brevirostrum*) Atlantic sturgeon (*Acipenser oxyrhynchus*) American eel (*Anguilla rostrata*) Blueback herring (*Alosa aestivalis*)	p. 30	p. 31	p. 32	p. 33
Alewife (*Alosa pseudoharengus*) American shad (*Alosa sapidissima*) Atlantic menhaden (*Brevoortia tyrannus*) Atlantic herring (*Clupea harengus*) Bay anchovy (*Anchoa mitchilli*) Channel catfish (*Ictalurus punctatus*)	p. 34	p. 35	p. 36	p. 37
Rainbow smelt (*Osmerus mordax*) Atlantic salmon (*Salmo salar*) Atlantic cod (*Gadus morhua*) Haddock (*Melanogrammus aeglefinus*) Atlantic tomcod (*Microgadus tomcod*) Pollock (*Pollachius virens*)	p. 38	p. 39	p. 40	p. 41
Red hake (*Urophycis chuss*) Oyster toadfish (*Opsanus tau*) Sheepshead minnow (*Cyprinodon variegatus*) Killifishes (*Fundulus* species) Silversides (*Menidia* species) Northern pipefish (*Syngnathus fuscus*)	p. 42	p. 43	p. 44	p. 45
Northern searobin (*Prionotus carolinus*) White perch (*Morone americana*) Striped bass (*Morone saxatilis*) Black sea bass (*Centropristis striata*) Yellow perch (*Perca flavescens*) Bluefish (*Pomatomus saltatrix*)	p. 46	p. 47	p. 48	p. 49
Pinfish (*Lagodon rhomboides*) Scup (*Stenotomus chrysops*) Spotted seatrout (*Cynoscion nebulosus*) Weakfish (*Cynoscion regalis*) Spot (*Leiostomus xanthurus*) Northern kingfish (*Menticirrhus saxatilis*)	p. 50	p. 51	p. 52	p. 53
Atlantic croaker (*Micropogonias undulatus*) Black drum (*Pogonias cromis*) Red drum (*Sciaenops ocellatus*) Mullets (*Mugil* species) Tautog (*Tautoga onitis*) Cunner (*Tautogolabrus adspersus*)	p. 54	p. 55	p. 56	p. 57
American sand lance (*Ammodytes americanus*) Gobies (*Gobiosoma* species) Atlantic mackerel (*Scomber scombrus*) Butterfish (*Peprilus triacanthus*)	p. 58	p. 59	p. 60	p. 61
Summer flounder (*Paralichthys dentatus*) Windowpane flounder (*Scophthalmus aquosus*) Winter flounder (*Pleuronectes americanus*) Hogchoker (*Trinectes maculatus*)	p. 62	p. 63	p. 64	p. 65

Table 4. Spatial distribution and relative abundance

		Mid-Atlantic Estuaries																	
		Waquoit Bay			Buzzards Bay			Narragansett Bay			Long Island Sound			Connecticut River			Gardiners Bay		
Species/Life Stage		*	M	S	*	M	S	T	M	S	T	M	S	T	M	*	*	M	S
Blue mussel *Mytilus edulis*	A		√	√		○	●		○	○		○	○		○			○	○
	S		√	√		○	●		○	○		○	○		○			○	○
	J		√	√		○	●		○	○		○	○		○			○	○
	L		√	√		○	●		○	○		○	○		○			○	○
	E		√	√		●	●		○	○		○	○		○			○	○
Bay scallop *Argopecten irradians*	A		◉	◉		◉	◉		○	○		√	√		√			○	○
	S		○	○		○	○		○	○		√	√		√			○	○
	J		◉	◉		◉	◉		○	○		√	√		√			○	○
	L		○	○		○	○		○	○		√	√		√			○	○
	E		○	○		○	○		○	○		√	√		√			○	○
American oyster *Crassostrea virginica*	A		√	√		○	○		○	√		◉	○		◉			○	√
	S		√	√		○	○		○	√		◉	○		◉			○	√
	J		√	√		○	○		○	√		◉	○		◉			○	√
	L		√	√		○	○		○	√		◉	○		◉			○	√
	E		√	√		○	○		○	√		◉	○		◉			○	√
Northern quahog *Mercenaria mercenaria*	A		●	●		●	●		●	●		◉	◉		◉			◉	◉
	S		○	○		◉	◉		◉	◉		◉	◉		◉			◉	◉
	J		●	●		●	●		●	●		◉	◉		◉			◉	◉
	L		○	○		◉	◉		◉	◉		◉	◉		◉			◉	◉
	E		○	○		◉	◉		◉	◉		◉	◉		◉			◉	◉
Softshell clam *Mya arenaria*	A		◉	◉		○	◉		○	√		○	○		○			○	○
	S		◉	◉		○	◉		○	√		○	○		○			○	○
	J		◉	◉		○	◉		○	√		○	○		○			○	○
	L		◉	◉		○	◉		√	√		○	○		○			○	○
	E		◉	◉		○	◉		√	√		○	○		○			○	○
Brown shrimp *Penaeus aztecus*	A																		√
	S																		
	J																		
	L																		
	E																		
		*	M	S	*	M	S	T	M	S	T	M	S	T	M	*	*	M	S
		Waquoit Bay			Buzzards Bay			Narragansett Bay			Long Island Sound			Connecticut River			Gardiners Bay		
		Mid-Atlantic Estuaries																	

Relative Abundance

●	Highly Abundant
◉	Abundant
○	Common
√	Rare
Blank	Not Present

Salinity Zone

T - Tidal Fresh
M - Mixing
S - Seawater
* - Salinity zone not present

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs

Table 4, continued. Spatial distribution and relative abundance

		Mid-Atlantic Estuaries																	
		Great South Bay			Hudson R./ Raritan B.			Barnegat Bay			New Jersey Inland Bays			Delaware Bay			Delaware Inland Bays		
Species/Life Stage		*	M	S	T	M	S	T	M	S	T	M	S	T	M	S	*	M	S
Blue mussel *Mytilus edulis*	A		○	○		◉	◉		√	○		√	○		○	○		√	√
	S		○	◉		○	○		√	○		√	○		○	○		√	√
	J		○	○		◉	◉		√	○		√	○		○	○		○	○
	L		○	◉		○	○		√	○		√	○		○	○		√	√
	E		○	◉		○	○		√	○		√	○		○	○		√	√
Bay scallop *Argopecten irradians*	A		√	√														√	√
	S		√	√														na	na
	J		√	√														√	√
	L		√	√														na	na
	E		√	√														na	na
American oyster *Crassostrea virginica*	A		√	√		√	√		√	√		√	√		●	◉		√	√
	S		√	√		√	√		√	√		√	√		●	◉		√	√
	J		√	√		√	√		√	√		√	√		●	◉		√	√
	L		√	√		√	√		√	√		√	√		●	◉		√	√
	E		√	√		√	√		√	√		√	√		●	◉		√	√
Northern quahog *Mercenaria mercenaria*	A		●	●		◉	◉		◉	◉		◉	◉		◉	◉		●	●
	S		◉	◉		◉	◉		◉	◉		◉	◉		◉	◉		●	●
	J		●	●		◉	◉		◉	◉		◉	◉		●	●		●	●
	L		◉	◉		◉	◉		◉	◉		◉	◉		◉	◉		●	●
	E		◉	◉		◉	◉		◉	◉		◉	◉		◉	◉		●	●
Softshell clam *Mya arenaria*	A		○	○		◉	○		○	○		√	√		○	√		√	√
	S		○	○		○	○		○	○		√	√		○	√		√	√
	J		○	○		◉	○		○	○		√	√		◉	√		√	√
	L		○	○		○	○		○	○		√	√		○	√		√	√
	E		○	○		○	○		○	○		√	√		○	√		√	√
Brown shrimp *Penaeus aztecus*	A					√	√								√	√		√	√
	S																		
	J														√			√	√
	L																		
	E																		
		*	M	S	T	M	S	T	M	S	T	M	S	T	M	S	*	M	S
		Great South Bay			Hudson R./ Raritan B.			Barnegat Bay			New Jersey Inland Bays			Delaware Bay			Delaware Inland Bays		
		Mid-Atlantic Estuaries																	

Relative Abundance	
●	Highly Abundant
◉	Abundant
○	Common
√	Rare
Blank	Not Present
na	No Data Available

Salinity Zone

T - Tidal Fresh
M - Mixing
S - Seawater
* - Salinity zone not present

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs

Table 4, continued. Spatial distribution and relative abundance

		Mid-Atlantic Estuaries																	
		Chincoteague Bay			Chesapeake Bay Mainstem			Chester River			Choptank River			Patuxent River			Potomac River		
Species/Life Stage		*	*	S	T	M	S	T	M	*	T	M	*	T	M	*	T	M	*
Blue mussel *Mytilus edulis*	A					◉	◉												
	S					◉	◉												
	J			◉		◉	◉												
	L			√		◉	◉												
	E					◉	◉												
Bay scallop *Argopecten irradians*	A			√															
	S			√															
	J			√															
	L			√															
	E			√															
American oyster *Crassostrea virginica*	A			○		○	√		○			○			○			○	
	S			○		○	√		○			○			○			○	
	J			○		○	√		○			○			○			○	
	L			○		○	√		○			○			○			○	
	E			○		○	√		○			○			○			○	
Northern quahog *Mercenaria mercenaria*	A			●		○	○												
	S			●		○	○												
	J			●		○	○												
	L			●		○	○												
	E			●		○	○												
Softshell clam *Mya arenaria*	A					√			○			○			○			○	
	S					√			○			○			○			○	
	J					√			○			○			○			○	
	L					√			○			○			○			○	
	E					√			○			○			○			○	
Brown shrimp *Penaeus aztecus*	A			○		√	√											√	
	S																		
	J			○		√	√											√	
	L						√												
	E																		
		*	*	S	T	M	S	T	M	*	T	M	*	T	M	*	T	M	*
		Chincoteague Bay			Chesapeake Bay Mainstem			Chester River			Choptank River			Patuxent River			Potomac River		
		Mid-Atlantic Estuaries																	

Relative Abundance	
●	Highly Abundant
◉	Abundant
○	Common
√	Rare
Blank	Not Present

Salinity Zone

T - Tidal Fresh
M - Mixing
S - Seawater
* - Salinity zone not present

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs

Table 4, continued. Spatial distribution and relative abundance

		Mid-Atlantic Estuaries											
		Tangier / Pocomoke Sound			Rappahannock River			York River			James River		
Species/Life Stage		*	M	*	T	M	*	T	M	*	T	M	*
Blue mussel	A					○			○			○	
	S					○			○			○	
Mytilus edulis	J					○			○			○	
	L					○			○			○	
	E					○			○			○	
Bay scallop	A												
	S												
Argopecten irradians	J												
	L												
	E												
American oyster	A		○			◉			○			◉	
	S		○			◉			○			◉	
Crassostrea virginica	J		○			◉			○			◉	
	L		○			◉			○			◉	
	E		○			◉			○			◉	
Northern quahog	A					○			◉			◉	
	S					○			◉			◉	
Mercenaria mercenaria	J					○			◉			◉	
	L					○			◉			◉	
	E					○			◉			◉	
Softshell clam	A		○			○			√			√	
	S		○			○			√			√	
Mya arenaria	J		○			○			√			√	
	L		○			○			√			√	
	E		○			○			√			√	
Brown shrimp	A		√			√			√			√	
	S												
Penaeus aztecus	J		√			√			√			√	
	L												
	E												
		*	M	*	T	M	*	T	M	*	T	M	*
		Tangier / Pocomoke Sound			Rappahannock River			York River			James River		
		Mid-Atlantic Estuaries											

Relative Abundance

●	Highly Abundant
◉	Abundant
○	Common
√	Rare
Blank	Not Present

Salinity Zone

T - Tidal Fresh
M - Mixing
S - Seawater
* - Salinity zone not present

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs

Table 4, continued. Spatial distribution and relative abundance

		Mid-Atlantic Estuaries																	
		Waquoit Bay			Buzzards Bay			Narragansett Bay			Long Island Sound			Connecticut River			Gardiners Bay		
Species/Life Stage		*	M	S	*	M	S	T	M	S	T	M	S	T	M	*	*	M	S
Daggerblade grass shrimp *Palaemonetes pugio*	A		◉	◉		●	◉		●	●		◉	◉		◉			◉	◉
	S		○	○		◉	◉		◉	◉		○	○		○			○	○
	J		◉	◉		◉	◉		●	●		◉	◉		◉			◉	◉
	L		○	○		◉	◉		◉	◉		○	○		○			◉	◉
	E		○	○		◉	◉		◉	◉		○	○		○			◉	◉
Sevenspine bay shrimp *Crangon septemspinosa*	A		●	●		●	◉		◉	◉		●	●		◉			◉	◉
	S		◉	◉		◉	◉		◉	◉		◉	◉		◉			◉	◉
	J		●	●		◉	◉		◉	◉		●	●		◉			◉	◉
	L		◉	◉		◉	◉		◉	◉		◉	◉		◉			◉	◉
	E		◉	◉		◉	◉		◉	◉		◉	◉		◉			◉	◉
American lobster *Homarus americanus*	A			√		○	◉		√	◉		◉	●		○				○
	S					○	◉		√	◉		◉	●		○				○
	J		√	○		○	◉		√	◉		◉	●		○				○
	L			√		√	◉		√	○		◉	●		○				○
	E					○	◉		√	◉		◉	●		○				○
Blue crab *Callinectes sapidus*	A		○	○		○	○	√	○	○	○	○	○	○	○			○	○
	M		○	○		○	○	√	○	○	√	○	√	√	○			○	√
	J		○	○		○	○	√	○	○	○	○	○	○	○			○	○
	L		○	○		○	○		○	○		√	√		√			○	○
	E		○	○		○	○		○	○		○	○		○				○
Skates *Raja species*	A			√			◉			◉			●		○				○
	M			√			◉			◉			○						√
	J			√			◉			◉			●		○				○
	E			√			◉			◉			◉						√

* M S * M S T M S T M S T M * * M S
Waquoit Bay | Buzzards Bay | Narragansett Bay | Long Island Sound | Connecticut River | Gardiners Bay
Mid-Atlantic Estuaries

Relative Abundance	
●	Highly Abundant
◉	Abundant
○	Common
√	Rare
Blank	Not Present

Salinity Zone

T - Tidal Fresh
M - Mixing
S - Seawater
* - Salinity zone not present

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs
M - Mating

Table 4, continued. Spatial distribution and relative abundance

Species/Life Stage		Mid-Atlantic Estuaries																	
		Great South Bay			Hudson R./ Raritan B.			Barnegat Bay			New Jersey Inland Bays			Delaware Bay			Delaware Inland Bays		
		*	M	S	T	M	S	T	M	S	T	M	S	T	M	S	*	M	S
Daggerblade grass shrimp *Palaemonetes pugio*	A		●	●		●	●	√	●	◉	√	●	◉	√	●	◉		●	◉
	S		◉	◉		◉	◉	√	●	◉	√	●	◉	√	●	◉		●	◉
	J		●	●		●	●	√	●	●	√	●	◉	√	●	◉		●	◉
	L		◉	◉		◉	◉	√	●	◉	√	●	◉	√	●	◉		●	◉
	E		◉	◉		◉	◉	√	●	◉	√	●	◉	√	●	◉		●	◉
Sevenspine bay shrimp *Crangon septemspinosa*	A		●	●		◉	◉		◉	●		◉	●		◉	◉		◉	●
	S		●	●		○	○		◉	◉		◉	●		◉	◉		◉	●
	J		◉	◉		○	○		◉	◉		◉	●		◉	◉		◉	●
	L		●	●		○	○		◉	◉		◉	●		◉	◉		◉	●
	E		●	●		○	○		◉	◉		◉	●		◉	◉		◉	●
American lobster *Homarus americanus*	A			√		√	○								√	○		√	√
	S			√		√	○									○			√
	J			√		√	○								√	○		√	√
	L			○		○	○									○			√
	E			√		○	○									○			√
Blue crab *Callinectes sapidus*	A		○	◉	○	○	○	√	●	●	√	●	●	√	◉	◉		●	●
	M		○	○	○	○	○		●	√		●	√	√	○	√		◉	○
	J		○	◉	○	○	○	√	●	●	√	●	●	◉	◉	◉		●	●
	L		○	◉		○	○		◉	●		◉	●		√	◉		○	●
	E		√	◉		○	○		○	●		○	●			○			◉
Skates *Raja* species	A			○			○			○		√	○		○	○		○	○
	M			√			○		na	na		na	na		na	na		na	na
	J			○			○		na	na		na	na		na	na		na	na
	E			√			○		na	na		na	na		na	na		na	na

* M S T M S T M S T M S T M S * M S
Great South Bay | Hudson R./ Raritan B. | Barnegat Bay | New Jersey Inland Bays | Delaware Bay | Delaware Inland Bays
Mid-Atlantic Estuaries

Relative Abundance

●	Highly Abundant
◉	Abundant
○	Common
√	Rare
Blank	Not Present
na	No Data Available

Salinity Zone

T - Tidal Fresh
M - Mixing
S - Seawater
* - Salinity zone not present

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs
M - Mating

Table 4, continued. Spatial distribution and relative abundance

		Mid-Atlantic Estuaries																	
		Chincoteague Bay			Chesapeake Bay Mainstem			Chester River			Choptank River			Patuxent River			Potomac River		
Species/Life Stage		*	*	S	T	M	S	T	M	*	T	M	*	T	M	*	T	M	*
Daggerblade grass shrimp *Palaemonetes pugio*	A			●		●	●		●			●			●			●	
	S			●		●	●		●			●			●			●	
	J			●		●	●		●			●			●			●	
	L			●		●	●		●			●			●			●	
	E			●		●	●		●			●			●			●	
Sevenspine bay shrimp *Crangon septemspinosa*	A			●		○	○		○			○			○			○	
	S			●		○	○		○			○			○			○	
	J			●		○	○		○			○			○			○	
	L			●		○	○		○			○			○			○	
	E			●		○	○		○			○			○			○	
American lobster *Homarus americanus*	A						√												
	S																		
	J						√												
	L																		
	E																		
Blue crab *Callinectes sapidus*	A			●	○	●	●	○	●		○	●		○	●		○	●	
	M			●		●	√		●			●			●			●	
	J			◉	○	●	●	○	●		○	●		○	●		○	●	
	L			●		●	◉												
	E			●		○	●												
Skates *Raja species*	A			√		○	○												
	M			na															
	J			√		○	○												
	E						○												

* * S T M S T M * T M * T M * T M *
Chincoteague Bay | Chesapeake Bay Mainstem | Chester River | Choptank River | Patuxent River | Potomac River
Mid-Atlantic Estuaries

Relative Abundance

●	Highly Abundant
◉	Abundant
○	Common
√	Rare
Blank	Not Present
na	No Data Available

Salinity Zone

T - Tidal Fresh
M - Mixing
S - Seawater
* - Salinity zone not present

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs
M - Mating

Table 4, continued. Spatial distribution and relative abundance

		Mid-Atlantic Estuaries											
		Tangier / Pocomoke Sound			Rappa-hannock River			York River			James River		
Species/Life Stage		*	M	*	T	M	*	T	M	*	T	M	*
Daggerblade grass shrimp *Palaemonetes pugio*	A		●			●			●			●	
	S		●			●			●			●	
	J		●			●			●			●	
	L		●			●			●			●	
	E		●			●			●			●	
Sevenspine bay shrimp *Crangon septemspinosa*	A		○			○			○			○	
	S		○			○			○			○	
	J		○			○			○			○	
	L		○			○			○			○	
	E		○			○			○			○	
American lobster *Homarus americanus*	A												
	S												
	J												
	L												
	E												
Blue crab *Callinectes sapidus*	A		●		○	●		○	●		○	●	
	M		●			●			●			●	
	J		●		○	●		○	●		○	●	
	L					●			◉			◉	
	E												
Skates *Raja* species	A												
	M												
	J												
	E												
		*	M	*	T	M	*	T	M	*	T	M	*
		Tangier / Pocomoke Sound			Rappa-hannock River			York River			James River		
		Mid-Atlantic Estuaries											

Relative Abundance

●	Highly Abundant
◉	Abundant
○	Common
√	Rare
Blank	Not Present

Salinity Zone

T - Tidal Fresh
M - Mixing
S - Seawater
* - Salinity zone not present

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs
M - Mating

Table 4, continued. Spatial distribution and relative abundance

		Mid-Atlantic Estuaries																	
		Waquoit Bay			Buzzards Bay			Narragansett Bay			Long Island Sound			Connecticut River			Gardiners Bay		
Species/Life Stage		*	M	S	*	M	S	T	M	S	T	M	S	T	M	*	*	M	S
Atlantic stingray *Dasyatis sabina*	A												√						
	M																		
	J																		
	P																		
Cownose ray *Rhinoptera bonansus*	A						√					√	√					√	√
	M											√	√					√	√
	J									√		√	√					√	√
	P											√	√					√	√
Shortnose sturgeon *Acipenser brevirostrum*	A							√	√		√	√	√	√	√				
	S							√			√			√					
	J							√	√	√	○	√		√	√				
	L							√			√			√					
	E							√			√			√					
Atlantic sturgeon *Acipenser oxyrhynchus*	A					√	√	√	√	√	√	√	√	○	○			○	○
	S					√		√	√		√			○	√				
	J					√	√	√	√	√	√	√	√	○	○			○	○
	L					√		√	√		√			○	√				
	E					√		√	√		√			○	√				
American eel *Anguilla rostrata*	A		○	○		○	○	○	○	○	◉	○	○	◉	◉			√	○
	S																		
	J		◉	○		◉	○	◉	◉	○	○	○	○	◉	◉			○	○
	L		○	○		○	○		√	√	√	○	○		○			○	○
	E																		
Blueback herring *Alosa aestivalis*	A		○	○		○	○	○	○	○	●	●	◉	●	●			○	○
	S					√		○	√		◉	○		◉	√				
	J		○	○		○	○	○	○	○	●	○	○	●	○			○	○
	L		√			√		○	√		◉	○		◉	○				
	E					√		○	√		◉	○		◉	√				
		*	M	S	*	M	S	T	M	S	T	M	S	T	M	*	*	M	S
		Waquoit Bay			Buzzards Bay			Narragansett Bay			Long Island Sound			Connecticut River			Gardiners Bay		
		Mid-Atlantic Estuaries																	

Relative Abundance

●	Highly Abundant
◉	Abundant
○	Common
√	Rare
Blank	Not Present

Salinity Zone

T - Tidal Fresh
M - Mixing
S - Seawater
* - Salinity zone not present

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs
M - Mating
P - Parturition

Table 4, continued. Spatial distribution and relative abundance

		Mid-Atlantic Estuaries																	
		Great South Bay			Hudson R./ Raritan B.			Barnegat Bay			New Jersey Inland Bays			Delaware Bay			Delaware Inland Bays		
Species/Life Stage		*	M	S	T	M	S	T	M	S	T	M	S	T	M	S	*	M	S
Atlantic stingray *Dasyatis sabina*	A			√															
	M																		
	J																		
	P																		
Cownose ray *Rhinoptera bonansus*	A		√	√		√	√		√	√		√	√		√	√		√	√
	M		√	√		√	√		√	√		√	√		na	na		√	√
	J		√	√		√	√		√	√		√	√		√	√		√	√
	P		√	√		√	√		√	√		√	√		√	√		√	√
Shortnose sturgeon *Acipenser brevirostrum*	A				○	○	√							√	√	√			
	S				○														
	J				○	○	√							√	√	√			
	L				○														
	E				○														
Atlantic sturgeon *Acipenser oxyrhynchus*	A		√	√	○	√	√							√	√	√		√	√
	S				○	√								√	√			√	
	J		√	√	○	√	√							√	√	√		√	√
	L				○	√								√	√			√	
	E				○	√								√	√			√	
American eel *Anguilla rostrata*	A		○	○	○	○	○	√	√	√	√	√	√	√	√	○		√	√
	S																		
	J		○	○	◉	◉	√	○	○	√	○	○	√	○	◉	◉		○	√
	L		○	○		○	◉	○	○	○	○	○	○	√	○	○		√	√
	E																		
Blueback herring *Alosa aestivalis*	A		○	○	◉	◉	○	○	○	○		○	○	○	○	◉		√	√
	S				◉	○		○	○					◉	√			√	
	J		○	○	●	○	○	○	○	○		○	○	◉	◉	◉		√	√
	L				◉	○		○	○					◉	√			√	
	E				◉	○		○	○					◉	√			√	
		*	M	S	T	M	S	T	M	S	T	M	S	T	M	S	*	M	S
		Great South Bay			Hudson R./ Raritan B.			Barnegat Bay			New Jersey Inland Bays			Delaware Bay			Delaware Inland Bays		
		Mid-Atlantic Estuaries																	

Relative Abundance

●	Highly Abundant
◉	Abundant
○	Common
√	Rare
Blank	Not Present
na	No Data Available

Salinity Zone

T - Tidal Fresh
M - Mixing
S - Seawater
* - Salinity zone not present

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs
M - Mating
P - Parturition

Table 4, continued. Spatial distribution and relative abundance

		Mid-Atlantic Estuaries																	
		Chincoteague Bay			Chesapeake Bay Mainstem			Chester River			Choptank River			Patuxent River			Potomac River		
Species/Life Stage		*	*	S	T	M	S	T	M	*	T	M	*	T	M	*	T	M	*
Atlantic stingray *Dasyatis sabina*	A					√	√												
	M																		
	J					√	√												
	P																		
Cownose ray *Rhinoptera bonansus*	A			√		◉	◉		○			○			○			○	
	M																		
	J			√		◉	◉		○			○			○			○	
	P			√															
Shortnose sturgeon *Acipenser brevirostrum*	A																		
	S																		
	J																		
	L																		
	E																		
Atlantic sturgeon *Acipenser oxyrhynchus*	A					√	√										√	√	
	S																√		
	J					√												√	
	L																√		
	E																√		
American eel *Anguilla rostrata*	A			○			○												
	S																		
	J			●	○	◉	○	○	○		○	○		○	○		○	○	
	L			●			○												
	E																		
Blueback herring *Alosa aestivalis*	A				○	◉	◉	○	○		○	○		○	○		◉	○	
	S				○	√		○	○		○	○		○	○		◉	○	
	J			○	○	○	○	○	○		○	○		○	○		◉	◉	
	L				○	√		○	○		○	○		○	○		◉	○	
	E				○	√		○	○		○	○		○	○		◉	○	
		*	*	S	T	M	S	T	M	*	T	M	*	T	M	*	T	M	*
		Chincoteague Bay			Chesapeake Bay Mainstem			Chester River			Choptank River			Patuxent River			Potomac River		
		Mid-Atlantic Estuaries																	

Relative Abundance

●	Highly Abundant
◉	Abundant
○	Common
√	Rare
Blank	Not Present

Salinity Zone

T - Tidal Fresh
M - Mixing
S - Seawater
* - Salinity zone not present

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs
M - Mating
P - Parturition

Table 4, continued. Spatial distribution and relative abundance

		Mid-Atlantic Estuaries											
		Tangier / Pocomoke Sound			Rappa-hannock River			York River			James River		
Species/Life Stage		*	M	*	T	M	*	T	M	*	T	M	*
Atlantic stingray	A					√			√			√	
	M												
Dasyatis sabina	J					√			√			√	
	P												
Cownose ray	A		○			○			○			○	
	M												
Rhinoptera bonansus	J		○			○			○			○	
	P												
Shortnose sturgeon	A												
	S												
Acipenser brevirostrum	J												
	L												
	E												
Atlantic sturgeon	A		√			√			√			√	
	S												
Acipenser oxyrhynchus	J		√			√			√			√	
	L												
	E												
American eel	A												
	S												
Anguilla rostrata	J		○		○	○		○	○		○	○	
	L												
	E												
Blueback herring	A		◉		○	○		○	○		○	○	
	S				○	○		○	√		○	√	
Alosa aestivalis	J		○		○	○		○	○		○	○	
	L				○	○		○	√		○	√	
	E				○	○		○	√		○	√	

* M * T M * T M * T M *
Tangier / Pocomoke Sound | Rappa-hannock River | York River | James River
Mid-Atlantic Estuaries

Relative Abundance

●	Highly Abundant
◉	Abundant
○	Common
√	Rare
Blank	Not Present

Salinity Zone

T - Tidal Fresh
M - Mixing
S - Seawater
* - Salinity zone not present

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs
M - Mating
P - Parturition

Table 4, continued. Spatial distribution and relative abundance

		Mid-Atlantic Estuaries																	
		Waquoit Bay			Buzzards Bay			Narragansett Bay			Long Island Sound			Connecticut River			Gardiners Bay		
Species/Life Stage		*	M	S	*	M	S	T	M	S	T	M	S	T	M	*	*	M	S
Alewife *Alosa pseudoharengus*	A		○	○		○	○	○	○	○	●	◉	○	●	◉			○	○
	S					√		○	√		●			●					
	J		○	○		○	○	○	○	○	●	●	○	●	●			○	○
	L		√			√		○	√		●	○		●					
	E					√		○	√		◉			●					
American shad *Alosa sapidissima*	A		√	√		√	√	√	√	√	◉	◉	◉	●	◉			○	○
	S										◉			○					
	J		√	√		√	√	√	√	√	◉	◉	○	●	●			○	○
	L										●	◉		●	√				
	E										◉	○		◉	√				
Atlantic menhaden *Brevoortia tyrannus*	A		√	○		○	●	√	◉	◉	○	●	●	○	◉			◉	◉
	S						○		√	●			●						●
	J		√	√		◉	◉	◉	◉	◉	◉	●	●	◉	◉			◉	◉
	L		○	○		○	◉		○	●	○	◉	◉	√	◉			●	●
	E						◉		√	●			◉						●
Atlantic herring *Clupea harengus*	A			√		○	○		○	◉		○	◉		√			√	○
	S																		
	J		√	√		○	○		○	○		○	○		√			√	○
	L			√			√			○		√	√						
	E																		
Bay anchovy *Anchoa mitchilli*	A		√	√		○	◉	○	◉	◉	○	◉	○	●	●			●	●
	S		√	√		○	○	○	◉	◉	○	●	◉	○	●			●	●
	J		√	√		○	◉	○	◉	◉	○	◉	◉	○	◉			●	●
	L		√	√		○	◉	○	◉	◉	◉	●	◉	◉	●			●	●
	E		√	√		○	◉	○	◉	◉	○	●	●	○	●			●	●
Channel catfish *Ictalurus punctatus*	A							√			○	√		◉	○				
	S										√	√		◉					
	J							√			○	√		◉	○				
	L										√	√		◉					
	E										√	√		◉					
		*	M	S	*	M	S	T	M	S	T	M	S	T	M	*	*	M	S
		Waquoit Bay			Buzzards Bay			Narragansett Bay			Long Island Sound			Connecticut River			Gardiners Bay		
		Mid-Atlantic Estuaries																	

Relative Abundance

● Highly Abundant
◉ Abundant
○ Common
√ Rare
Blank Not Present

Salinity Zone

T - Tidal Fresh
M - Mixing
S - Seawater
* - Salinity zone not present

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs

Table 4, continued. Spatial distribution and relative abundance

		Mid-Atlantic Estuaries																	
		Great South Bay			Hudson R./ Raritan B.			Barnegat Bay			New Jersey Inland Bays			Delaware Bay			Delaware Inland Bays		
Species/Life Stage		*	M	S	T	M	S	T	M	S	T	M	S	T	M	S	*	M	S
Alewife	A		○	○	◉	◉	◉	◉	○	○	◉	○	○	○	○	○		√	√
	S				◉	○		◉	○		◉	○		○	√			√	
Alosa pseudoharengus	J		○	○	●	◉	○	◉	◉	◉	◉	◉	◉	○	○	◉		√	√
	L				●	○		◉	○		◉	○		◉	√			√	
	E				◉	○		◉	○		◉	○		○	√			√	
American shad	A		○	○	●	◉	○		√	√		√	√	◉	◉	◉		√	√
	S				●									◉				√	
Alosa sapidissima	J		○	○	●	●	○		√	√		√	√	◉	○	○		√	√
	L				●	●								◉				√	
	E				●	●								○				√	
Atlantic menhaden	A		◉	◉	√	◉	◉		○	○		○	○	√	◉	◉		◉	○
	S			◉			○			○			○			√			
Brevoortia tyrannus	J		◉	◉	◉	◉	◉		◉	◉		◉	◉	√	◉	◉		◉	○
	L		○	◉	○	◉	○		○	○		○	○	√	○	√		√	√
	E		○	◉			○			○			○			√			
Atlantic herring	A			◉		○	○		○	○		○	○		√	○			√
	S																		
Clupea harengus	J			○		○	○		○	○		○	○		○	○			√
	L					○	○		√	√		√	√		√	√			
	E																		
Bay anchovy	A		◉	●	○	●	◉	√	◉	◉	√	◉	◉	√	●	●		●	●
	S		●	●	◉	●	◉		◉	◉		◉	◉		●	◉		●	●
Anchoa mitchilli	J		◉	◉	○	●	◉	√	◉	◉	√	◉	◉	√	●	●		●	●
	L		●	●	●	●	◉	√	◉	◉	√	◉	◉	√	●	◉		●	●
	E		●	●	◉	●	◉		◉	◉		◉	◉		●	●		●	●
Channel catfish	A				√			√			na			○	○				
	S							na			na			√	√				
Ictalurus punctatus	J				√			√			na			○	○				
	L							na			na			√	√				
	E							na			na			√	√				
		*	M	S	T	M	S	T	M	S	T	M	S	T	M	S	*	M	S
		Great South Bay			Hudson R./ Raritan B.			Barnegat Bay			New Jersey Inland Bays			Delaware Bay			Delaware Inland Bays		
		Mid-Atlantic Estuaries																	

Relative Abundance

●	Highly Abundant
◉	Abundant
○	Common
√	Rare
Blank	Not Present
na	No Data Available

Salinity Zone

T - Tidal Fresh
M - Mixing
S - Seawater
* - Salinity zone not present

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs

Table 4, continued. Spatial distribution and relative abundance

		Mid-Atlantic Estuaries																	
		Chincoteague Bay			Chesapeake Bay Mainstem			Chester River			Choptank River			Patuxent River			Potomac River		
Species/Life Stage		*	*	S	T	M	S	T	M	*	T	M	*	T	M	*	T	M	*
Alewife *Alosa pseudoharengus*	A				○	◉	◉	○	○		○	○		○	○		◉	◉	
	S				○	○		○	○		○	○		○	○		◉	○	
	J			√	○	○	○	○	○		○	○		○	○		◉	◉	
	L				○	○		○	○		○	○		○	○		◉	○	
	E				○	○		○	○		○	○		○	○		◉	○	
American shad *Alosa sapidissima*	A				√	○	○	○	○		○	○		√	√		○	○	
	S				√	√		○	√		○	√		√	√		○	√	
	J				√	√	○	○	○		○	○		√	√		○	○	
	L				√	√		○	√		○	√		√	√		○	√	
	E				√	√		○	√		○	√		√	√		○	√	
Atlantic menhaden *Brevoortia tyrannus*	A			○		●	●		√			√			√			√	
	S					○	○												
	J			◉	●	●	●	●	●		●	●		●	●		●	●	
	L			√		○	●												
	E					○	○												
Atlantic herring *Clupea harengus*	A					√	○												
	S																		
	J			√			√												
	L																		
	E																		
Bay anchovy *Anchoa mitchilli*	A			●	◉	●	●	○	●		○	●		◉	●		○	●	
	S			●		●	●		●			●			●			●	
	J			●	●	●	●	●	●		●	●		◉	●		●	●	
	L			●		●	●		●			●			●			●	
	E			●		●	●		●			●			●			●	
Channel catfish *Ictalurus punctatus*	A			√	○	○		○	○		○	○		○	○		○	○	
	S				○			○			○			○			○		
	J			√	○	○		○	○		○	○		○	○		○	○	
	L				○			○			○			○			○		
	E				○			○			○			○			○		
		*	*	S	T	M	S	T	M	*	T	M	*	T	M	*	T	M	*
		Chincoteague Bay			Chesapeake Bay Mainstem			Chester River			Choptank River			Patuxent River			Potomac River		
		Mid-Atlantic Estuaries																	

Relative Abundance

●	Highly Abundant
◉	Abundant
○	Common
√	Rare
Blank	Not Present

Salinity Zone

T - Tidal Fresh
M - Mixing
S - Seawater
* - Salinity zone not present

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs

Table 4, continued. Spatial distribution and relative abundance

		Mid-Atlantic Estuaries											
		Tangier / Pocomoke Sound			Rappa-hannock River			York River			James River		
Species/Life Stage		*	M	*	T	M	*	T	M	*	T	M	*
Alewife *Alosa pseudoharengus*	A		◉		○	○		○	○		○	○	
	S				○	○		○	○		○	○	
	J		○		○	○		○	○		○	○	
	L				○	○		○	○		○	○	
	E				○	○		○	○		○	○	
American shad *Alosa sapidissima*	A		○		○	○		○	○		○	○	
	S				○	√		○	√		○	√	
	J		○		○	○		○	○		○	○	
	L				○	√		○	√		○	√	
	E				○	√		○	√		○	√	
Atlantic menhaden *Brevoortia tyrannus*	A		◉			√			√			√	
	S												
	J		◉		●	●		●	●		●	●	
	L					√			√			√	
	E												
Atlantic herring *Clupea harengus*	A					√			√			√	
	S												
	J												
	L												
	E												
Bay anchovy *Anchoa mitchilli*	A		●		●	●		●	●		●	●	
	S		●			●			●			●	
	J		●		●	●		●	●		●	●	
	L		●			●			●			●	
	E		●			●			●			●	
Channel catfish *Ictalurus punctatus*	A		○		○	○		○	○		○	○	
	S				○			○			○		
	J		○		○	○		○	○		○	○	
	L				○			○			○		
	E				○			○			○		

*	M	*	T	M	*	T	M	*	T	M	*
Tangier / Pocomoke Sound			Rappa-hannock River			York River			James River		
Mid-Atlantic Estuaries											

Relative Abundance

●	Highly Abundant
◉	Abundant
○	Common
√	Rare
Blank	Not Present

Salinity Zone

T - Tidal Fresh
M - Mixing
S - Seawater
* - Salinity zone not present

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs

Table 4, continued. Spatial distribution and relative abundance

		Mid-Atlantic Estuaries																	
		Waquoit Bay			Buzzards Bay			Narragansett Bay			Long Island Sound			Connecticut River			Gardiners Bay		
Species/Life Stage		*	M	S	*	M	S	T	M	S	T	M	S	T	M	*	*	M	S
Rainbow smelt	A		√	√		○	○	○	○	○	○	√	√	○	○			○	○
	S		√			○		○	√	√	◉	○		◉	○				
Osmerus mordax	J		○	√		○	√	√	○	○	○	√	√	○	○				
	L		√			√	√	○	√		◉	◉		◉	◉				
	E		√			√		○	√		◉	○		◉	○				
Atlantic salmon	A										√	√	√	√	√			√	√
	S																		
Salmo salar	J										√	√		○	○			√	√
	L																		
	E																		
Atlantic cod	A						○			√			√						√
	S												√						√
Gadus morhua	J			√			○			√			√						√
	L			√			○			√			√						√
	E			√			○			√			√						√
Haddock	A						√						√						√
	S																		
Melanogrammus aeglefinus	J						√			√			√						√
	L						√			√									
	E						√												
Atlantic tomcod	A		○	○		○	√	○	○	√	○	○	○	○	○			○	○
	S		○	√		○		○	○		○	◉		○	◉			○	√
Microgadus tomcod	J		○	○		○	○	√	○	√	○	◉	◉	○	○			○	○
	L		○	√		○		√	√		○	◉		○	◉			○	√
	E		○	√		○		○	○		○	◉		○	◉			○	√
Pollock	A									√			○						√
	S																		
Pollachius virens	J			○			√			√		√	○						√
	L			√			√			√		√	√						√
	E			√			√												
		*	M	S	*	M	S	T	M	S	T	M	S	T	M	*	*	M	S
		Waquoit Bay			Buzzards Bay			Narragansett Bay			Long Island Sound			Connecticut River			Gardiners Bay		
		Mid-Atlantic Estuaries																	

Relative Abundance	
●	Highly Abundant
◉	Abundant
○	Common
√	Rare
Blank	Not Present

Salinity Zone

T - Tidal Fresh
M - Mixing
S - Seawater
* - Salinity zone not present

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs

Table 4, continued. Spatial distribution and relative abundance

		Mid-Atlantic Estuaries																	
		Great South Bay			Hudson R./ Raritan B.			Barnegat Bay			New Jersey Inland Bays			Delaware Bay			Delaware Inland Bays		
Species/Life Stage		*	M	S	T	M	S	T	M	S	T	M	S	T	M	S	*	M	S
Rainbow smelt *Osmerus mordax*	A				√	√	√												
	S				√	√													
	J				√	√	√												
	L				√	√													
	E				√	√													
Atlantic salmon *Salmo salar*	A			√															
	S																		
	J																		
	L																		
	E																		
Atlantic cod *Gadus morhua*	A																		
	S																		
	J																		
	L					√	√												
	E																		
Haddock *Melanogrammus aeglefinus*	A																		
	S																		
	J																		
	L																		
	E																		
Atlantic tomcod *Microgadus tomcod*	A		○	○	◉	◉	√												
	S		√		◉	◉													
	J		○	○	○	◉	√												
	L		○	√	◉	●													
	E		○	√	◉	◉													
Pollock *Pollachius virens*	A						√												
	S																		
	J			○			√		√	√		√	√			√			
	L																		
	E																		
		*	M	S	T	M	S	T	M	S	T	M	S	T	M	S	*	M	S
		Great South Bay			Hudson R./ Raritan B.			Barnegat Bay			New Jersey Inland Bays			Delaware Bay			Delaware Inland Bays		
		Mid-Atlantic Estuaries																	

Relative Abundance

- ● Highly Abundant
- ◉ Abundant
- ○ Common
- √ Rare
- Blank Not Present

Salinity Zone

- T - Tidal Fresh
- M - Mixing
- S - Seawater
- * - Salinity zone not present

Life Stage

- A - Adults
- S - Spawning adults
- J - Juveniles
- L - Larvae
- E - Eggs

Table 4, continued. Spatial distribution and relative abundance

		Mid-Atlantic Estuaries																	
		Chincoteague Bay			Chesapeake Bay Mainstem			Chester River			Choptank River			Patuxent River			Potomac River		
Species/Life Stage		*	*	S	T	M	S	T	M	*	T	M	*	T	M	*	T	M	*
Rainbow smelt *Osmerus mordax*	A																		
	S																		
	J																		
	L																		
	E																		
Atlantic salmon *Salmo salar*	A																		
	S																		
	J																		
	L																		
	E																		
Atlantic cod *Gadus morhua*	A																		
	S																		
	J																		
	L																		
	E																		
Haddock *Melanogrammus aeglefinus*	A																		
	S																		
	J																		
	L																		
	E																		
Atlantic tomcod *Microgadus tomcod*	A																		
	S																		
	J																		
	L																		
	E																		
Pollock *Pollachius virens*	A																		
	S																		
	J																		
	L																		
	E																		
		*	*	S	T	M	S	T	M	*	T	M	*	T	M	*	T	M	*
		Chincoteague Bay			Chesapeake Bay Mainstem			Chester River			Choptank River			Patuxent River			Potomac River		
		Mid-Atlantic Estuaries																	

Relative Abundance

●	Highly Abundant
◉	Abundant
○	Common
√	Rare
Blank	Not Present

Salinity Zone

T - Tidal Fresh
M - Mixing
S - Seawater
* - Salinity zone not present

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs

Table 4, continued. Spatial distribution and relative abundance

		Mid-Atlantic Estuaries											
		Tangier / Pocomoke Sound			Rappahannock River			York River			James River		
Species/Life Stage		*	M	*	T	M	*	T	M	*	T	M	*
Rainbow smelt *Osmerus mordax*	A												
	S												
	J												
	L												
	E												
Atlantic salmon *Salmo salar*	A												
	S												
	J												
	L												
	E												
Atlantic cod *Gadus morhua*	A												
	S												
	J												
	L												
	E												
Haddock *Melanogrammus aeglefinus*	A												
	S												
	J												
	L												
	E												
Atlantic tomcod *Microgadus tomcod*	A												
	S												
	J												
	L												
	E												
Pollock *Pollachius virens*	A												
	S												
	J												
	L												
	E												
		*	M	*	T	M	*	T	M	*	T	M	*
		Tangier / Pocomoke Sound			Rappahannock River			York River			James River		
		Mid-Atlantic Estuaries											

Relative Abundance

● Highly Abundant
◉ Abundant
○ Common
√ Rare
Blank Not Present

Salinity Zone

T - Tidal Fresh
M - Mixing
S - Seawater
* - Salinity zone not present

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs

Table 4, continued. Spatial distribution and relative abundance

		Mid-Atlantic Estuaries																	
		Waquoit Bay			Buzzards Bay			Narragansett Bay			Long Island Sound			Connecticut River			Gardiners Bay		
Species/Life Stage		*	M	S	*	M	S	T	M	S	T	M	S	T	M	*	*	M	S
Red hake *Urophycis chuss*	A					○	○		√	○		○	◉		○			√	√
	S						○			○									
	J					○	○		√	○		○	◉		○			√	√
	L					√	○		√	○									√
	E					√	○		√	○									
Oyster toadfish *Opsanus tau*	A		○	○		○	○		○	○		○	√		√			○	○
	S		○	○		○	○		○	○		○	√		√			○	○
	J		○	○		○	○		○	○		○	√		√			○	○
	L		○	○		○	○		○	○		○	√		√			○	○
	E		○	○		○	○		○	○		○	√		√			○	○
Sheepshead minnow *Cyprinodon variegatus*	A		○	○		○	√	√	√	√	√	○	○	√	○			○	○
	S		○	○		√	√		○	○		○	√		○			○	○
	J		○	○		○	√	√	√	√	√	○	√	√	○			○	○
	L		○	○		√	√		○	○		○	√		○			○	○
	E		○	○		√	√		○	○		○	○		○			○	○
Killifishes *Fundulus species*	A		●	●		◉	○	○	◉	◉	○	◉	◉	○	◉			◉	◉
	S		●	●		○	○	○	○	○	○	◉	◉	○	◉			◉	◉
	J		●	●		◉	○	○	◉	◉	○	◉	◉	○	◉			◉	◉
	L		●	●		○	○	○	○	○	○	◉	○	○	◉			◉	◉
	E		●	●		○	○	○	○	○	○	◉	○	○	◉			◉	◉
Silversides *Menidia species*	A		◉	●		●	●	○	◉	◉	○	◉	●	√	◉			◉	●
	S		◉	◉		◉	◉	○	◉	◉	○	◉	√	○	◉			◉	◉
	J		●	●		●	●	○	●	◉	○	●	●	√	◉			◉	●
	L		◉	◉		◉	◉	○	◉	◉	○	◉	√	○	◉			◉	○
	E		◉	◉		◉	◉	○	◉	◉	○	◉	√	○	◉			◉	○
Northern pipefish *Syngnathus fuscus*	A		○	○		○	○		○	○		○	○		○			○	○
	M		○	○		○	○		○	○		○	○		○			○	○
	J		○	○		○	○		○	○		○	○		○			○	○
	L		○	○		◉	◉		○	○		√	√		○			○	○
		*	M	S	*	M	S	T	M	S	T	M	S	T	M	*	*	M	S
		Waquoit Bay			Buzzards Bay			Narragansett Bay			Long Island Sound			Connecticut River			Gardiners Bay		
		Mid-Atlantic Estuaries																	

Relative Abundance

●	Highly Abundant
◉	Abundant
○	Common
√	Rare
Blank	Not Present

Salinity Zone

T - Tidal Fresh
M - Mixing
S - Seawater
* - Salinity zone not present

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs
M - Mating

Table 4, continued. Spatial distribution and relative abundance

		Mid-Atlantic Estuaries																	
		Great South Bay			Hudson R./ Raritan B.			Barnegat Bay			New Jersey Inland Bays			Delaware Bay			Delaware Inland Bays		
Species/Life Stage		*	M	S	T	M	S	T	M	S	T	M	S	T	M	S	*	M	S
Red hake	A			√		○	○									○			√
	S															na			
Urophycis chuss	J			√		○	○		√	√		√	√		√	√			√
	L				√	○	○									na			
	E			√												na			
Oyster toadfish	A		◉	○		○	○		○	○		○	○		○	○		○	○
	S		○	√		○	○		○	○		○	○		○	○		○	○
Opsanus tau	J		◉	○		○	○		○	○		○	○		○	○		○	○
	L		○	√		○	○		○	○		○	○		○	○		○	○
	E		○	√		○	○		○	○		○	○		○	○		○	○
Sheepshead minnow	A		◉	◉	√	○	○	√	○	○	√	○	○	√	○	○		○	○
	S		○			○	○	√	○	○	√	○	○	√	○	○		○	○
Cyprinodon variegatus	J		◉	◉	√	○	○	√	○	○	√	○	○	√	○	○		○	○
	L		○			○	○	√	○	○	√	○	○	√	○	○		○	○
	E		○			○	○	√	○	○	√	○	○	√	○	○		○	○
Killifishes	A		●	◉	◉	◉	◉	○	◉	◉	○	◉	◉	○	●	●		◉	◉
	S		◉	◉	◉	◉	◉	○	◉	◉	○	◉	◉	○	●	●		◉	◉
Fundulus species	J		●	◉	◉	◉	◉	○	◉	◉	○	◉	◉	○	●	●		◉	◉
	L		◉	◉	◉	◉	◉	○	◉	◉	○	◉	◉	○	●	●		◉	◉
	E		◉	◉	◉	◉	◉	○	◉	◉	○	◉	◉	○	●	●		◉	◉
Silversides	A		●	●	○	◉	●	√	●	●	√	●	●	√	●	●		●	●
	S		◉	◉	○	◉	◉		●	●		●	●		●	●		●	●
Menidia species	J		●	●	○	◉	●	√	●	●	√	●	●	√	●	●		●	●
	L		◉	◉	○	◉	◉		●	●		●	●		●	●		●	●
	E		◉	◉	○	◉	◉		●	●		●	●		●	●		●	●
Northern pipefish	A		◉	◉		○	○		○	○		○	○		○	○		○	√
	M		○	○		○	○		○	○		○	○		○	○		○	√
Syngnathus fuscus	J		◉	◉		○	○		○	○		○	○		○	○		○	√
	L		○	○	√	○	○		○	○		○	○		○	○		○	√

* M S T M S T M S T M S T M S * M S
Great South Bay | Hudson R./ Raritan B. | Barnegat Bay | New Jersey Inland Bays | Delaware Bay | Delaware Inland Bays
Mid-Atlantic Estuaries

Relative Abundance		Salinity Zone	Life Stage
●	Highly Abundant	T - Tidal Fresh	A - Adults
◉	Abundant	M - Mixing	S - Spawning adults
○	Common	S - Seawater	J - Juveniles
√	Rare	* - Salinity zone not present	L - Larvae
Blank	Not Present		E - Eggs
na	No Data Available		M - Mating

Table 4, continued. Spatial distribution and relative abundance

Species/Life Stage		Mid-Atlantic Estuaries																	
		Chincoteague Bay			Chesapeake Bay Mainstem			Chester River			Choptank River			Patuxent River			Potomac River		
		*	*	S	T	M	S	T	M	*	T	M	*	T	M	*	T	M	*
Red hake	A					√	○												
	S																		
Urophycis chuss	J			√		√	○												
	L																		
	E																		
Oyster toadfish	A			○		○	○		○			○			○			○	
	S			○		○	○		○			○			○			○	
Opsanus tau	J			○		○	○		○			○			○			○	
	L			○		○	○		○			○			○			○	
	E			○		○	○		○			○			○			○	
Sheepshead minnow	A			○	√	◉	◉	√	◉		√	◉		√	◉		√	◉	
	S			○	√	◉	◉	√	◉		√	◉		√	◉		√	◉	
Cyprinodon variegatus	J			○	√	◉	◉	√	◉		√	◉		√	◉		√	◉	
	L			○	√	◉	◉	√	◉		√	◉		√	◉		√	◉	
	E			○	√	◉	◉	√	◉		√	◉		√	◉		√	◉	
Killifishes	A			◉	◉	●	●	◉	●		◉	●		◉	●		◉	●	
	S			◉	◉	●	●	◉	●		◉	●		◉	●		◉	●	
Fundulus species	J			◉	◉	●	●	◉	●		◉	●		◉	●		◉	●	
	L			◉	◉	●	●	◉	●		◉	●		◉	●		◉	●	
	E			◉	◉	●	●	◉	●		◉	●		◉	●		◉	●	
Silversides	A			●	◉	●	◉	◉	●		◉	●		◉	●		◉	●	
	S			◉	◉	●	◉	◉	●		◉	●		◉	●		◉	●	
Menidia species	J			●	◉	●	◉	◉	●		◉	●		◉	●		◉	●	
	L			◉	◉	●	◉	◉	●		◉	●		◉	●		◉	●	
	E			◉	◉	●	◉	◉	●		◉	●		◉	●		◉	●	
Northern pipefish	A			○	√	○	○	√	○		√	○		√	○		√	○	
	M			√		○	○		○			○			○			○	
Syngnathus fuscus	J			○	√	○	○	√	○		√	○		√	○		√	○	
	L			√		○	○		○			○			○			○	
		*	*	S	T	M	S	T	M	*	T	M	*	T	M	*	T	M	*
		Chincoteague Bay			Chesapeake Bay Mainstem			Chester River			Choptank River			Patuxent River			Potomac River		
		Mid-Atlantic Estuaries																	

Relative Abundance

●	Highly Abundant
◉	Abundant
○	Common
√	Rare
Blank	Not Present

Salinity Zone

T - Tidal Fresh
M - Mixing
S - Seawater
* - Salinity zone not present

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs
M - Mating

Table 4, continued. Spatial distribution and relative abundance

		Mid-Atlantic Estuaries											
		Tangier / Pocomoke Sound			Rappa-hannock River			York River			James River		
Species/Life Stage		*	M	*	T	M	*	T	M	*	T	M	*
Red hake *Urophycis chuss*	A					√			√			√	
	S												
	J					√			√			√	
	L												
	E												
Oyster toadfish *Opsanus tau*	A		○			○			○			○	
	S		○			○			○			○	
	J		○			○			○			○	
	L		○			○			○			○	
	E		○			○			○			○	
Sheepshead minnow *Cyprinodon variegatus*	A		◉		√	◉		√	◉		√	◉	
	S		◉		√	◉		√	◉		√	◉	
	J		◉		√	◉		√	◉		√	◉	
	L		◉		√	◉		√	◉		√	◉	
	E		◉		√	◉		√	◉		√	◉	
Killifishes *Fundulus species*	A		●		◉	●		◉	●		◉	●	
	S		●		◉	●		◉	●		◉	●	
	J		●		◉	●		◉	●		◉	●	
	L		●		◉	●		◉	●		◉	●	
	E		●		◉	●		◉	●		◉	●	
Silversides *Menidia species*	A		●		◉	●		◉	●		◉	●	
	S		●		◉	●		◉	●		◉	●	
	J		●		◉	●		◉	●		◉	●	
	L		●		◉	●		◉	●		◉	●	
	E		●		◉	●		◉	●		◉	●	
Northern pipefish *Syngnathus fuscus*	A		○		√	○		√	○		√	○	
	M		○		√	○		√	○		√	○	
	J		○		√	○		√	○		√	○	
	L		○		√	○		√	○		√	○	
		*	M	*	T	M	*	T	M	*	T	M	*
		Tangier / Pocomoke Sound			Rappa-hannock River			York River			James River		
		Mid-Atlantic Estuaries											

Relative Abundance

●	Highly Abundant
◉	Abundant
○	Common
√	Rare
Blank	Not Present

Salinity Zone

T - Tidal Fresh
M - Mixing
S - Seawater
* - Salinity zone not present

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs
M - Mating

Table 4, continued. Spatial distribution and relative abundance

		Mid-Atlantic Estuaries																	
		Waquoit Bay			Buzzards Bay			Narragansett Bay			Long Island Sound			Connecticut River			Gardiners Bay		
Species/Life Stage		*	M	S	*	M	S	T	M	S	T	M	S	T	M	*	*	M	S
Northern searobin *Prionotus carolinus*	A		○	○		○	○		○	○		○	○		○			○	○
	S		○	○		○	○		○	◉		○	○		○			○	◉
	J		○	○		○	○		○	○		○	○		○			○	○
	L		○	○		○	○		○	○		○	○		○			○	◉
	E		○	○		○	○		○	◉		○	○		○			○	◉
White perch *Morone americana*	A		√	√		○	√	◉	◉	○	●	○	√	●	◉			○	√
	S		√			○		○	○		●	○		●	●			○	
	J		√	√		○	√	○	○	○	●	○		●	◉			○	√
	L		√			√		○	○		●	○		●	●			○	
	E		√			√		○	○		●	○		●	●			○	
Striped bass *Morone saxatilis*	A		√	○		√	○	○	○	○	○	○	◉	◉	◉			○	○
	S																		
	J		√	○		√	○	√	√	○	○	◉	◉	◉	◉			○	○
	L																		
	E																		
Black sea bass *Centropristis striata*	A			√		√	○		√	○		√	√					√	○
	S						○												
	J			√		√	○		√	○		√	○					√	○
	L						○			√									
	E						○												
Yellow perch *Perca flavescens*	A					√		○	○		○	√		◉	○				
	S					√		○	√		◉	√		◉					
	J					√		○	○		○	√		◉	○				
	L					√		○	√		◉	○		◉	√				
	E					√		○	√		◉	√		◉					
Bluefish *Pomatomus saltatrix*	A		√	○		○	○		○	○		○	◉		○			○	○
	S																		√
	J		○	○		◉	◉	√	◉	◉	√	◉	◉		◉			◉	◉
	L			√			√		√	○									√
	E																		√
		*	M	S	*	M	S	T	M	S	T	M	S	T	M	*	*	M	S
		Waquoit Bay			Buzzards Bay			Narragansett Bay			Long Island Sound			Connecticut River			Gardiners Bay		
		Mid-Atlantic Estuaries																	

Relative Abundance

●	Highly Abundant
◉	Abundant
○	Common
√	Rare
Blank	Not Present

Salinity Zone

T - Tidal Fresh
M - Mixing
S - Seawater
* - Salinity zone not present

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs

Table 4. Spatial distribution and relative abundance

		Mid-Atlantic Estuaries																	
		Great South Bay			Hudson R./ Raritan B.			Barnegat Bay			New Jersey Inland Bays			Delaware Bay			Delaware Inland Bays		
Species/Life Stage		*	M	S	T	M	S	T	M	S	T	M	S	T	M	S	*	M	S
Northern searobin	A		○	○		○	○		○	○		○	○		○	○		○	○
	S		○	○		√	√		√	√		√	√		○	○		○	○
Prionotus carolinus	J		○	○		○	○		○	○		○	○		○	○		○	○
	L		○	◉		√	√		na	na		na	na		○	○		○	○
	E		○	◉		○	√		na	na		na	na		○	○		○	○
White perch	A		○	○	●	●	○	○	○	√	◉	◉	√	◉	◉	◉		√	√
	S				●	◉		○	○		◉	◉		◉	◉				
Morone americana	J		○	○	●	●	○	○	○	√	◉	◉	√	○	◉	◉		√	√
	L				●	●		○	○		◉	◉		◉	◉				
	E				●	◉		○	○		◉	◉		◉	◉				
Striped bass	A		○	◉	◉	◉	○	√	√	√	√	√	√	○	○	○		√	○
	S				●	◉								○					
Morone saxatilis	J		○	◉	◉	◉	○	√	√	√	√	√	√	○	○	√		√	√
	L				●	●								○					
	E				●	◉								○					
Black sea bass	A			○		√	√		○	◉		○	◉		√	○			√
	S																		
Centropristis striata	J					√	√		○	◉		○	◉		○	○		○	○
	L									√									
	E																		
Yellow perch	A				○	○		○	○		◉	○		○	○			√	
	S				○	√		○			◉			○					
Perca flavescens	J				○	○		○	○		◉	○		○	○			√	
	L				○	○		○			◉			○					
	E				○	√		○			◉			○					
Bluefish	A		○	◉		○	○		○	○		○	○		○	○		○	○
	S																		
Pomatomus saltatrix	J		◉	◉	√	◉	◉		◉	◉		◉	◉	√	◉	◉		○	○
	L				√	√	√			√			√			√			
	E						√												
		*	M	S	T	M	S	T	M	S	T	M	S	T	M	S	*	M	S
		Great South Bay			Hudson R./ Raritan B.			Barnegat Bay			New Jersey Inland Bays			Delaware Bay			Delaware Inland Bays		
		Mid-Atlantic Estuaries																	

Relative Abundance

●	Highly Abundant
◉	Abundant
○	Common
√	Rare
Blank	Not Present
na	No Data Available

Salinity Zone

T - Tidal Fresh
M - Mixing
S - Seawater
* - Salinity zone not present

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs

Table 4, continued. Spatial distribution and relative abundance

		Mid-Atlantic Estuaries																	
		Chincoteague Bay			Chesapeake Bay Mainstem			Chester River			Choptank River			Patuxent River			Potomac River		
Species/Life Stage		*	*	S	T	M	S	T	M	*	T	M	*	T	M	*	T	M	*
Northern searobin	A			○		√	√					√			√			√	
	S			√															
Prionotus carolinus	J			○		○	◉					√			√			√	
	L			√															
	E			√															
White perch	A			○	◉	◉		◉	◉		◉	○		◉	◉		◉	◉	
	S			○	◉	○		◉	◉		◉	○		◉	○		◉	○	
Morone americana	J			○	◉	◉		◉	◉		○	○		○	◉		◉	◉	
	L			○	◉	○		◉	◉		◉	○		◉	○		◉	○	
	E			○	◉	○		◉	◉		◉	○		◉	○		◉	○	
Striped bass	A				○	○	○	○	○		○	○		◉	○		◉	○	
	S				○			○			○			◉			◉		
Morone saxatilis	J				○	○		○	○		○	○		○	○		○	○	
	L				○			○			○			◉			◉		
	E				○			○			○			◉			◉		
Black sea bass	A			○		○	○		√			√			√			√	
	S																		
Centropristis striata	J			○		○	○		√			√			√			√	
	L																		
	E																		
Yellow perch	A				○	○		○	○		○	○		○	○		○	○	
	S				○	○		○	○		○	○		○	○		○	○	
Perca flavescens	J				○	○		○	○		○	○			○		○	○	
	L				○	○		○	○		○	○		○	○		○	○	
	E				○	○		○	○		○	○		○	○		○	○	
Bluefish	A			○		◉	◉		○			○			○			◉	
	S																		
Pomatomus saltatrix	J			○		◉	◉		○			○			○			◉	
	L																		
	E																		
		*	*	S	T	M	S	T	M	*	T	M	*	T	M	*	T	M	*
		Chincoteague Bay			Chesapeake Bay Mainstem			Chester River			Choptank River			Patuxent River			Potomac River		
		Mid-Atlantic Estuaries																	

Relative Abundance

●	Highly Abundant
◉	Abundant
○	Common
√	Rare
Blank	Not Present

Salinity Zone

T - Tidal Fresh
M - Mixing
S - Seawater
* - Salinity zone not present

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs

Table 4, continued. Spatial distribution and relative abundance

		Mid-Atlantic Estuaries											
		Tangier / Pocomoke Sound			Rappahannock River			York River			James River		
Species/Life Stage		*	M	*	T	M	*	T	M	*	T	M	*
Northern searobin	A		√			√			√			√	
	S												
Prionotus carolinus	J		√			√			√			√	
	L												
	E												
White perch	A		○		◉	◉		◉	◉		◉	◉	
	S		○		◉	○		◉	○		◉	○	
Morone americana	J		○		◉	◉		◉	◉		◉	◉	
	L		○		◉	○		◉	○		◉	○	
	E		○		◉	○		◉	○		◉	○	
Striped bass	A		○		○	○		○	○		○	○	
	S				○			○			○		
Morone saxatilis	J		○		○	○		○	○		○	○	
	L				○			○			○		
	E				○			○			○		
Black sea bass	A		○			√			√			○	
	S												
Centropristis striata	J		○			√			√			○	
	L												
	E												
Yellow perch	A		√		○	○		○	○		○	○	
	S				○	○		○	○		○	○	
Perca flavescens	J		√		○	○		○	○		○	○	
	L		√		○	○		○	○		○	○	
	E				○	○		○	○		○	○	
Bluefish	A		◉			◉			◉			◉	
	S												
Pomatomus saltatrix	J		◉			◉			◉			◉	
	L												
	E												
		*	M	*	T	M	*	T	M	*	T	M	*
		Tangier / Pocomoke Sound			Rappahannock River			York River			James River		
		Mid-Atlantic Estuaries											

Relative Abundance

●	Highly Abundant
◉	Abundant
○	Common
√	Rare
Blank	Not Present

Salinity Zone

T - Tidal Fresh
M - Mixing
S - Seawater
* - Salinity zone not present

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs

Table 4, continued. Spatial distribution and relative abundance

		Mid-Atlantic Estuaries																	
		Waquoit Bay			Buzzards Bay			Narragansett Bay			Long Island Sound			Connecticut River			Gardiners Bay		
Species/Life Stage		*	M	S	*	M	S	T	M	S	T	M	S	T	M	*	*	M	S
Pinfish	A									√									
	S																		
Lagodon rhomboides	J																		
	L																		
	E																		
Scup	A		√	○		√	●		◉	○		√	●		√			√	◉
	S			○			◉			○			◉						◉
Stenotomus chrysops	J		√	○		√	●		●	◉		√	●		√			√	◉
	L		√	◉		√	◉		√	○		√	◉		√			√	◉
	E		√	◉		○	◉		√	○		√	◉		√			√	◉
Spotted seatrout	A																		
	S																		
Cynoscion nebulosus	J																		
	L																		
	E																		
Weakfish	A		√	√		○	√		○	○		○	○		√			◉	◉
	S					○	○		○	○			√					◉	◉
Cynoscion regalis	J		√	√		○	√		○	○		◉	◉		√			○	○
	L					○	○		○	○			√					◉	◉
	E					○	○		○	○			√					◉	◉
Spot	A								√	√		√	√		√			√	√
	S																		
Leiostomus xanthurus	J						√		√	○		√	√		√			√	√
	L									√									
	E									√									
Northern kingfish	A			√		√	√		√	√		√	√					○	○
	S			√			√			√			√						○
Menticirrhus saxatilis	J			√		√	√		√	√		√	√					○	○
	L			√		√	√		√	√			√						○
	E			√		√	√		√	√			√						○
		*	M	S	*	M	S	T	M	S	T	M	S	T	M	*	*	M	S
		Waquoit Bay			Buzzards Bay			Narragansett Bay			Long Island Sound			Connecticut River			Gardiners Bay		
		Mid-Atlantic Estuaries																	

Relative Abundance		Salinity Zone	Life Stage
●	Highly Abundant	T - Tidal Fresh	A - Adults
◉	Abundant	M - Mixing	S - Spawning adults
○	Common	S - Seawater	J - Juveniles
√	Rare	* - Salinity zone not present	L - Larvae
Blank	Not Present		E - Eggs

Table 4, continued. Spatial distribution and relative abundance

		Mid-Atlantic Estuaries																	
		Great South Bay			Hudson R./ Raritan B.			Barnegat Bay			New Jersey Inland Bays			Delaware Bay			Delaware Inland Bays		
Species/Life Stage		*	M	S	T	M	S	T	M	S	T	M	S	T	M	S	*	M	S
Pinfish	A					√	√					√	√						√
	S																		
Lagodon rhomboides	J					√	√					√	√			√			√
	L															√			√
	E																		
Scup	A			○		√	○		√	√		√	√		√	○			○
	S						○												
Stenotomus chrysops	J			○		√	◉		√	○		√	○		○	○			○
	L					√	○												
	E					√	○												
Spotted seatrout	A								√	√			√			√			√
	S																		
Cynoscion nebulosus	J								√	√			√						
	L																		
	E																		
Weakfish	A		○	○		○	○		○	○		○	○		◉	◉		○	○
Cynoscion regalis	S			○		◉	○			√			○		◉	◉			○
	J		○	○	√	◉	◉	√	○	○	√	○	○		◉	◉		○	○
	L			○	○	○	○		√	√		√	√		◉	◉		○	○
	E			○		◉	○			√			√		◉	◉			○
Spot	A		○	○		○	○		●	●		●	●		◉	◉		○	●
	S																		
Leiostomus xanthurus	J		○	○		◉	◉	○	●	●	○	●	●	○	◉	◉		◉	●
	L					√	√			√			√		○	◉		√	○
	E																		√
Northern kingfish	A		○	○		○	○		√	√		√	√		√	√		√	○
	S			○			√												
Menticirrhus saxatilis	J		○	○		○	○		√	√		√	√		√	√		○	○
	L			○			√		na	na		na	na		√	√			
	E			○			√		na	na		na	na						

* M S T M S T M S T M S T M S * M S
Great South Bay | Hudson R./ Raritan B. | Barnegat Bay | New Jersey Inland Bays | Delaware Bay | Delaware Inland Bays
Mid-Atlantic Estuaries

Relative Abundance	
●	Highly Abundant
◉	Abundant
○	Common
√	Rare
Blank	Not Present
na	No Data Available

Salinity Zone

T - Tidal Fresh
M - Mixing
S - Seawater
* - Salinity zone not present

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs

Table 4, continued. Spatial distribution and relative abundance

		Mid-Atlantic Estuaries																	
		Chincoteague Bay			Chesapeake Bay Mainstem			Chester River			Choptank River			Patuxent River			Potomac River		
Species/Life Stage		*	*	S	T	M	S	T	M	*	T	M	*	T	M	*	T	M	*
Pinfish *Lagodon rhomboides*	A					○	○												
	S																		
	J			√		○	○												
	L			√															
	E																		
Scup *Stenotomus chrysops*	A					○	○												
	S																		
	J			√		○	◉												
	L																		
	E																		
Spotted seatrout *Cynoscion nebulosus*	A					○	○		○			○			○			○	
	S						√												
	J			√		○	○		○			○			○			○	
	L					○	○					√						√	
	E					√	√												
Weakfish *Cynoscion regalis*	A			○		○	○		○			○			○			○	
	S					○	○												
	J			◉		○	○		○			○			○			○	
	L					○	◉												
	E					○	◉												
Spot *Leiostomus xanthurus*	A			◉		◉	◉					◉							
	S																		
	J			◉	○	◉	◉	○	○		○	◉		○	○		○	○	
	L																		
	E																		
Northern kingfish *Menticirrhus saxatilis*	A					√	√								√			√	
	S																		
	J			√		√	√								√			√	
	L					√	√												
	E					na	na												

* * S T M S T M * T M * T M * T M *
Chincoteague Bay | Chesapeake Bay Mainstem | Chester River | Choptank River | Patuxent River | Potomac River
Mid-Atlantic Estuaries

Relative Abundance

●	Highly Abundant
◉	Abundant
○	Common
√	Rare
Blank	Not Present
na	No Data Available

Salinity Zone

T - Tidal Fresh
M - Mixing
S - Seawater
* - Salinity zone not present

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs

Table 4, continued. Spatial distribution and relative abundance

		Mid-Atlantic Estuaries											
		Tangier / Pocomoke Sound			Rappahannock River			York River			James River		
Species/Life Stage		*	M	*	T	M	*	T	M	*	T	M	*
Pinfish	A											○	
	S												
Lagodon rhomboides	J											○	
	L												
	E												
Scup	A		√									√	
	S												
Stenotomus chrysops	J		√						√			√	
	L												
	E												
Spotted seatrout	A		○			○			○			○	
	S												
Cynoscion nebulosus	J		○			○			○			○	
	L		○			○			○			○	
	E					√			√			√	
Weakfish	A		○			○			○			○	
	S		√			○			○			○	
Cynoscion regalis	J		○			○			○			○	
	L		√			○			○			○	
	E		√			○			○			○	
Spot	A		◉			◉			◉			◉	
	S												
Leiostomus xanthurus	J		◉		○	◉		○	◉		○	◉	
	L												
	E												
Northern kingfish	A		√			√			√			√	
	S												
Menticirrhus saxatilis	J		√			√			√			√	
	L												
	E												
		*	M	*	T	M	*	T	M	*	T	M	*
		Tangier / Pocomoke Sound			Rappahannock River			York River			James River		
		Mid-Atlantic Estuaries											

Relative Abundance	
●	Highly Abundant
◉	Abundant
○	Common
√	Rare
Blank	Not Present

Salinity Zone

T - Tidal Fresh
M - Mixing
S - Seawater
* - Salinity zone not present

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs

Table 4, continued. Spatial distribution and relative abundance

		Mid-Atlantic Estuaries																	
		Waquoit Bay			Buzzards Bay			Narragansett Bay			Long Island Sound			Connecticut River			Gardiners Bay		
Species/Life Stage		*	M	S	*	M	S	T	M	S	T	M	S	T	M	*	*	M	S
Atlantic croaker	A																	√	√
	S																		
Micropogonias undulatus	J																	√	√
	L																		
	E																		
Black drum	A									√									
	S																		
Pogonias cromis	J									√									
	L																		
	E																		
Red drum	A																		
	S																		
Sciaenops ocellatus	J																		
	L																		
	E																		
Mullets	A		√	√		√	√	√	√	√	√	√	√		√			√	√
	S																		
Mugil species	J		○	○		√	√	√	√	√	√	√	√		√			○	○
	L																		
	E																		
Tautog	A		○	◉		◉	◉		○	○		○	○		○			○	○
	S		○	○		●	●		◉	◉			◉						◉
Tautoga onitis	J		○	◉		○	◉		○	○		○	○		○			○	○
	L		○	●		●	●		◉	○		○	○		○			○	○
	E		○	●		●	●		◉	◉		◉	◉		◉			◉	◉
Cunner	A		○	◉		●	●		○	○		○	○		○			○	○
	S		○	◉		●	●			◉			●						◉
Tautogolabrus adspersus	J		○	●		●	●		○	○		○	○		○			○	○
	L		◉	●		●	●		○	○		○	◉		○			○	○
	E		◉	●		●	●		○	◉		○	◉		○			○	◉
		*	M	S	*	M	S	T	M	S	T	M	S	T	M	*	*	M	S
		Waquoit Bay			Buzzards Bay			Narragansett Bay			Long Island Sound			Connecticut River			Gardiners Bay		
		Mid-Atlantic Estuaries																	

Relative Abundance

●	Highly Abundant
◉	Abundant
○	Common
√	Rare
Blank	Not Present

Salinity Zone

T - Tidal Fresh
M - Mixing
S - Seawater
* - Salinity zone not present

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs

Table 4, continued. Spatial distribution and relative abundance

Species/Life Stage		Great South Bay			Hudson R./ Raritan B.			Barnegat Bay			New Jersey Inland Bays			Delaware Bay			Delaware Inland Bays		
		*	M	S	T	M	S	T	M	S	T	M	S	T	M	S	*	M	S
Atlantic croaker	A					√	√		√	√		√	√		√	√		√	√
	S																		
Micropogonias undulatus	J					√	√		√	√		√	√		○	○		○	○
	L					√	√			√			√		√	√			√
	E																		√
Black drum	A					√	√		√	√		√	√		√	√			√
	S															√			
Pogonias cromis	J					√	√		√	√		√	√		√	√		√	√
	L															√			√
	E															√			
Red drum	A								√	√		√	√			√		√	√
	S																		
Sciaenops ocellatus	J								√	√		√	√			√			
	L																		
	E																		
Mullets	A		√	√		○	○		○	○		○	○					○	○
	S																		
Mugil species	J		○	○		○	○		○	○		○	○	√	○	○		○	○
	L														○	○			
	E																		
Tautog	A		○	◉		○	○		○	○		○	○			○			√
	S		○	◉			○		○	○		○	○			√			√
Tautoga onitis	J		○	○		○	◉		○	○		○	○			○		√	√
	L		○	○		○	○		○	○		○	○			√			√
	E		○	◉		○	○		○	○		○	○			√			√
Cunner	A		○	◉		√	√		○	○		○	○			√			
	S			◉			○		○	○		○	○			√			
Tautogolabrus adspersus	J		○	◉		√	√		○	○		○	○			√			
	L		○	○		○	○		○	○		○	○			√			
	E		○	◉		○	○		○	○		○	○			√			

Mid-Atlantic Estuaries

Relative Abundance	
●	Highly Abundant
◉	Abundant
○	Common
√	Rare
Blank	Not Present

Salinity Zone

T - Tidal Fresh
M - Mixing
S - Seawater
* - Salinity zone not present

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs

Table 4, continued. Spatial distribution and relative abundance

		Mid-Atlantic Estuaries																	
		Chincoteague Bay			Chesapeake Bay Mainstem			Chester River			Choptank River			Patuxent River			Potomac River		
Species/Life Stage		*	*	S	T	M	S	T	M	*	T	M	*	T	M	*	T	M	*
Atlantic croaker	A					○	√		√			√			√			√	
	S																		
Micropogonias undulatus	J			○	√	◉	◉	√	○		√	○		√	○		√	○	
	L																		
	E																		
Black drum	A					○	○					○			√			○	
	S						○												
Pogonias cromis	J					○	○		√			○			√			○	
	L						○												
	E						○												
Red drum	A					○	○					√			√			○	
	S																		
Sciaenops ocellatus	J					○	○		√			√			√			○	
	L					na	√												
	E					na	na												
Mullets	A			○		○	○								√			√	
	S																		
Mugil species	J			○		○	○								√			√	
	L																		
	E																		
Tautog	A			√		√	○		√			√			√			√	
	S					√	○												
Tautoga onitis	J			√		○	○		√			√			√			√	
	L					√	○												
	E					√	○												
Cunner	A																		
	S																		
Tautogolabrus adspersus	J			√															
	L																		
	E																		
		*	*	S	T	M	S	T	M	*	T	M	*	T	M	*	T	M	*
		Chincoteague Bay			Chesapeake Bay Mainstem			Chester River			Choptank River			Patuxent River			Potomac River		
		Mid-Atlantic Estuaries																	

Relative Abundance

●	Highly Abundant
◉	Abundant
○	Common
√	Rare
Blank	Not Present
na	No Data Available

Salinity Zone

T - Tidal Fresh
M - Mixing
S - Seawater
* - Salinity zone not present

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs

Table 4, continued. Spatial distribution and relative abundance

		Mid-Atlantic Estuaries											
		Tangier / Pocomoke Sound			Rappahannock River			York River			James River		
Species/Life Stage		*	M	*	T	M	*	T	M	*	T	M	*
Atlantic croaker	A		○			○			○			○	
	S												
Micropogonias undulatus	J		○		√	◉		√	◉		√	◉	
	L												
	E												
Black drum	A		○			○			○			○	
	S												
Pogonias cromis	J		○			○			○			○	
	L												
	E												
Red drum	A		○			○			○			○	
	S												
Sciaenops ocellatus	J		○			○			○			○	
	L												
	E												
Mullets	A		√			√			√			√	
	S												
Mugil species	J		√			√			√			√	
	L												
	E												
Tautog	A		○			√			√			○	
	S					√			√			√	
Tautoga onitis	J		○			○			○			○	
	L					√			√			√	
	E					√			√			√	
Cunner	A												
	S												
Tautogolabrus adspersus	J												
	L												
	E												

* M * T M * T M * T M *
Tangier / Pocomoke Sound | Rappahannock River | York River | James River
Mid-Atlantic Estuaries

Relative Abundance

●	Highly Abundant
◉	Abundant
○	Common
√	Rare
Blank	Not Present

Salinity Zone

T - Tidal Fresh
M - Mixing
S - Seawater
* - Salinity zone not present

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs

Table 4, continued. Spatial distribution and relative abundance

		Mid-Atlantic Estuaries																	
		Waquoit Bay			Buzzards Bay			Narragansett Bay			Long Island Sound			Connecticut River			Gardiners Bay		
Species/Life Stage		*	M	S	*	M	S	T	M	S	T	M	S	T	M	*	*	M	S
American sand lance *Ammodytes americanus*	A		√	○		○	◉		○	○		○	◉		○			○	◉
	S			○		√	○		√	○		○	●		○			○	●
	J		√	○		○	◉		○	○		○	◉		○			○	◉
	L		√	◉		○	●		○	◉		○	●		○			○	●
	E			○		√	○		√	○		○	●		○			○	●
Gobies *Gobiosoma* species	A		√	√		√	√		○	○	√	○	○	√	○			○	○
	S		√	√		√	√		◉	◉		○			○			○	○
	J		√	√		√	√		○	○	√	○	○	√	○			○	○
	L		√	√		√	√		◉	◉	○	○		○	○			○	○
	E		√	√		√	√		◉	◉		○			○			○	○
Atlantic mackerel *Scomber scombrus*	A			○			○			○			○						○
	S												√						√
	J			√		√	√		√	○		√	○						○
	L			√		√	√		√	○			○						●
	E			√		√	◉		√	◉			◉						●
Butterfish *Peprilus triacanthus*	A		√	○		○	●		○	◉		◉	●		○			○	○
	S			√			√			√			○						○
	J		√	○		○	●		○	◉	√	◉	●		○			○	○
	L		√	○		√	○		√	○			○						○
	E		√	○		√	○		√	◉			○						○
		*	M	S	*	M	S	T	M	S	T	M	S	T	M	*	*	M	S
		Waquoit Bay			Buzzards Bay			Narragansett Bay			Long Island Sound			Connecticut River			Gardiners Bay		
		Mid-Atlantic Estuaries																	

Relative Abundance	
●	Highly Abundant
◉	Abundant
○	Common
√	Rare
Blank	Not Present

Salinity Zone

T - Tidal Fresh
M - Mixing
S - Seawater
* - Salinity zone not present

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs

Table 4, continued. Spatial distribution and relative abundance

		Mid-Atlantic Estuaries																	
		Great South Bay			Hudson R./ Raritan B.			Barnegat Bay			New Jersey Inland Bays			Delaware Bay			Delaware Inland Bays		
Species/Life Stage		*	M	S	T	M	S	T	M	S	T	M	S	T	M	S	*	M	S
American sand lance *Ammodytes americanus*	A		○	○		○	◉		○	○		○	○			√			
	S		○	◉		√	○		√	○		√	○			√			
	J		○	○		○	◉		○	○		○	○			√			
	L		○	●	√	○	◉		○	○		○	○			√			
	E		○	●		√	○		√	○		√	○			√			
Gobies *Gobiosoma* species	A		○	○		○	○	√	○	○	√	○	○	√	○	○		◉	◉
	S		○			○		na	○	○	na	○	○	√	○	○		○	○
	J		○	○		○	○	√	○	○	√	○	○	√	○	○		◉	◉
	L		√		√	◉		na	◉	◉	na	◉	◉	√	○	○		◉	◉
	E		√			○		na	◉	◉	na	◉	◉	√	○	○		◉	◉
Atlantic mackerel *Scomber scombrus*	A			○			○									√			√
	S																		
	J			○		√	○			√			√						
	L			○						√			√						
	E			○						√			√						
Butterfish *Peprilus triacanthus*	A		√	○		○	○		√	√			√		√	○			○
	S			○												√			
	J		√	○	√	○	○		○	○		○	○		○	○			○
	L			○	√	○	√			√			√			○			
	E			○			√									√			
		*	M	S	T	M	S	T	M	S	T	M	S	T	M	S	*	M	S
		Great South Bay			Hudson R./ Raritan B.			Barnegat Bay			New Jersey Inland Bays			Delaware Bay			Delaware Inland Bays		
		Mid-Atlantic Estuaries																	

Relative Abundance

●	Highly Abundant
◉	Abundant
○	Common
√	Rare
Blank	Not Present
na	No Data Available

Salinity Zone

T - Tidal Fresh
M - Mixing
S - Seawater
* - Salinity zone not present

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs

Table 4, continued. Spatial distribution and relative abundance

		Mid-Atlantic Estuaries																	
		Chincoteague Bay			Chesapeake Bay Mainstem			Chester River			Choptank River			Patuxent River			Potomac River		
Species/Life Stage		*	*	S	T	M	S	T	M	*	T	M	*	T	M	*	T	M	*
American sand lance *Ammodytes americanus*	A			√															
	S																		
	J			√															
	L																		
	E																		
Gobies *Gobiosoma species*	A			○	√	◉	◉	√	◉		√	◉		√	◉		√	◉	
	S			○	na	◉	◉	na	◉		na	◉		na	◉		na	◉	
	J			○	√	◉	◉	√	◉		√	◉		√	◉		√	◉	
	L			○	◉	◉	◉	◉	◉		◉	◉		◉	◉		◉	◉	
	E			○	na	◉	◉	na	◉		na	◉		na	◉		na	◉	
Atlantic mackerel *Scomber scombrus*	A					√	√												
	S																		
	J					√	√												
	L						√												
	E						na												
Butterfish *Peprilus triacanthus*	A					○	○					√			√			√	
	S					○	○												
	J					○	○					√			√			√	
	L					○	○												
	E					○	○												
		*	*	S	T	M	S	T	M	*	T	M	*	T	M	*	T	M	*
		Chincoteague Bay			Chesapeake Bay Mainstem			Chester River			Choptank River			Patuxent River			Potomac River		
		Mid-Atlantic Estuaries																	

Relative Abundance

●	Highly Abundant
◉	Abundant
○	Common
√	Rare
Blank	Not Present

Salinity Zone

T - Tidal Fresh
M - Mixing
S - Seawater
* - Salinity zone not present

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs

Table 4, continued. Spatial distribution and relative abundance

		Mid-Atlantic Estuaries											
		Tangier / Pocomoke Sound			Rappa-hannock River			York River			James River		
Species/Life Stage		*	M	*	T	M	*	T	M	*	T	M	*
American sand lance *Ammodytes americanus*	A												
	S												
	J												
	L												
	E												
Gobies *Gobiosoma* species	A		◉		√	◉		√	◉		√	◉	
	S		◉		na	◉		na	◉		na	◉	
	J		◉		√	◉		√	◉		√	◉	
	L		◉		√	◉		√	◉		√	◉	
	E		◉		na	◉		na	◉		na	◉	
Atlantic mackerel *Scomber scombrus*	A					√			√			√	
	S												
	J					√			√			√	
	L												
	E												
Butterfish *Peprilus triacanthus*	A		√			√			○			○	
	S												
	J		√			√			○			○	
	L												
	E												

* M * T M * T M * T M *
Tangier / Pocomoke Sound | Rappa-hannock River | York River | James River
Mid-Atlantic Estuaries

Relative Abundance

●	Highly Abundant
◉	Abundant
○	Common
√	Rare
Blank	Not Present
na	No Data Available

Salinity Zone

T - Tidal Fresh
M - Mixing
S - Seawater
* - Salinity zone not present

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs

Table 4, continued. Spatial distribution and relative abundance

Species/Life Stage		Mid-Atlantic Estuaries																	
		Waquoit Bay			Buzzards Bay			Narragansett Bay			Long Island Sound			Connecticut River			Gardiners Bay		
		*	M	S	*	M	S	T	M	S	T	M	S	T	M	*	*	M	S
Summer flounder	A		√	√		○	○	√	√	○		√	√		○			○	○
	S																		
Paralichthys dentatus	J		√	○		○	○	√	√	√		√	√		○			○	○
	L		√	√		√	√		√	√									
	E						√			√									
Windowpane flounder	A		○	○		◉	◉	√	◉	◉	√	●	●		●			○	○
	S		○	○		○	○		○	○		●	●		●			○	○
Scophthalamus aquosus	J		○	○		◉	◉	√	◉	◉	√	●	●		●			○	○
	L		○	○		○	○		○	○		◉	◉		◉			○	○
	E		○	○		○	○		○	○		●	●		●			○	○
Winter flounder	A		◉	◉		●	●		○	○		●	●		●			◉	◉
	S		◉	◉		●	◉		◉	◉		◉	◉		◉			○	○
Pleuronectes americanus	J		●	●		●	●		◉	◉	√	●	●	√	●			◉	◉
	L		◉	◉		◉	◉		●	●		◉	◉		◉			○	○
	E		◉	◉		◉	◉		●	◉		◉	◉		◉			○	○
Hogchoker	A		√	√		○	√	○	○	○	○	○	√	√	○			○	○
	S		√	√		○	√	○	○	√	√	○	√	√	○			○	○
Trinectes maculatus	J		√	√		○	√	○	○	○	○	○	√	◉	○			○	√
	L		√	√		○	√	○	○	√	○	○	√	○	○			○	○
	E		√	√		○	√	○	○	√	√	○	√	√	○			○	○
		*	M	S	*	M	S	T	M	S	T	M	S	T	M	*	*	M	S
		Waquoit Bay			Buzzards Bay			Narragansett Bay			Long Island Sound			Connecticut River			Gardiners Bay		
		Mid-Atlantic Estuaries																	

Relative Abundance

- ● Highly Abundant
- ◉ Abundant
- ○ Common
- √ Rare
- Blank Not Present

Salinity Zone

- T - Tidal Fresh
- M - Mixing
- S - Seawater
- * - Salinity zone not present

Life Stage

- A - Adults
- S - Spawning adults
- J - Juveniles
- L - Larvae
- E - Eggs

Table 4, continued. Spatial distribution and relative abundance

		Mid-Atlantic Estuaries																	
		Great South Bay			Hudson R./ Raritan B.			Barnegat Bay			New Jersey Inland Bays			Delaware Bay			Delaware Inland Bays		
Species/Life Stage		*	M	S	T	M	S	T	M	S	T	M	S	T	M	S	*	M	S
Summer flounder	A		○	○		○	○		○	○		○	○		○	○		○	●
	S																		
Paralichthys dentatus	J		○	○		○	○		○	○		○	○		○	○		◉	●
	L				√	√	√		√	√		√	√					√	◉
	E						√												
Windowpane flounder	A		◉	◉	√	○	○		●	●		●	●		◉	◉		○	○
	S		◉	◉		√	○		●	●		●	●					○	○
Scophthalamus aquosus	J		◉	◉	√	○	○		●	●		●	●		◉	◉		○	○
	L		○	○	√	○	○		●	●		●	●					○	○
	E		◉	◉	√	√	○		●	●		●	●					○	○
Winter flounder	A		●	●		◉	◉		○	◉		○	○		○	○		○	○
	S		◉	◉		◉	◉		○	◉		○	○		○	○		○	○
Pleuronectes americanus	J		●	●		◉	◉		○	◉		○	○		○	○		○	○
	L		◉	◉	√	◉	◉		○	◉		○	○		○	○		○	○
	E		◉	◉		◉	◉		○	◉		○	○		○	○		○	○
Hogchoker	A		○	√	◉	◉	√	○	◉	○	○	◉	○	○	●	●		●	◉
	S		○	○	○	●			◉	○		◉	○		●	●		●	◉
Trinectes maculatus	J		○	√	○	◉	√	○	◉	○	○	◉	○	○	●	◉		●	◉
	L		○	○	○	◉	√		◉	○		◉	○		●	●		●	◉
	E		○	○	○	●			◉	○		◉	○		●	●		●	◉
		*	M	S	T	M	S	T	M	S	T	M	S	T	M	S	*	M	S
		Great South Bay			Hudson R./ Raritan B.			Barnegat Bay			New Jersey Inland Bays			Delaware Bay			Delaware Inland Bays		
		Mid-Atlantic Estuaries																	

Relative Abundance

●	Highly Abundant
◉	Abundant
○	Common
√	Rare
Blank	Not Present

Salinity Zone

T - Tidal Fresh
M - Mixing
S - Seawater
* - Salinity zone not present

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs

Table 4, continued. Spatial distribution and relative abundance

		Mid-Atlantic Estuaries																	
		Chincoteague Bay			Chesapeake Bay Mainstem			Chester River			Choptank River			Patuxent River			Potomac River		
Species/Life Stage		*	*	S	T	M	S	T	M	*	T	M	*	T	M	*	T	M	*
Summer flounder *Paralichthys dentatus*	A			●		○	○		○			○			○			○	
	S																		
	J			●		○	√		○			○			○			○	
	L					○	○												
	E																		
Windowpane flounder *Scophthalamus aquosus*	A			○		○	○												
	S																		
	J			○		○	○												
	L						√												
	E																		
Winter flounder *Pleuronectes americanus*	A			○		√	√		√			√			√			√	
	S					√			√			√			√			√	
	J			○		√	√		√			√			√			√	
	L					√			√			√			√			√	
	E					na			√			√			√			√	
Hogchoker *Trinectes maculatus*	A			○	○	●	●	○	●		○	●		○	●		○	●	
	S			○		●	●		●			●			●			●	
	J			○	○	●	●	○	●		○	●		○	●		○	●	
	L			○	√	●	●	√	●		√	●		√	●		√	●	
	E			○		●	●		●			●			●			●	
		*	*	S	T	M	S	T	M	*	T	M	*	T	M	*	T	M	*
		Chincoteague Bay			Chesapeake Bay Mainstem			Chester River			Choptank River			Patuxent River			Potomac River		
		Mid-Atlantic Estuaries																	

Relative Abundance

●	Highly Abundant
◉	Abundant
○	Common
√	Rare
Blank	Not Present
na	No Data Available

Salinity Zone

T - Tidal Fresh
M - Mixing
S - Seawater
* - Salinity zone not present

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs

Table 4, continued. Spatial distribution and relative abundance

		Mid-Atlantic Estuaries											
		Tangier / Pocomoke Sound			Rappa-hannock River			York River			James River		
Species/Life Stage		*	M	*	T	M	*	T	M	*	T	M	*
Summer flounder *Paralichthys dentatus*	A		○			○			○			○	
	S												
	J		○			○			○			○	
	L					○			○			○	
	E												
Windowpane flounder *Scophthalamus aquosus*	A		○									√	
	S												
	J		○						√			√	
	L												
	E												
Winter flounder *Pleuronectes americanus*	A		√			√			√			√	
	S		√			√			√			√	
	J		√			√			√			√	
	L		√			√			√			√	
	E		√			na			na			na	
Hogchoker *Trinectes maculatus*	A		●		◉	●		◉	●		○	●	
	S		●			●			●			●	
	J		●		◉	●		◉	●		○	●	
	L		●		√	●		√	●		√	●	
	E		●			●			●			●	

* M * T M * T M * T M *
Tangier / Pocomoke Sound | Rappa-hannock River | York River | James River
Mid-Atlantic Estuaries

Relative Abundance

●	Highly Abundant
◉	Abundant
○	Common
√	Rare
Blank	Not Present
na	No Data Available

Salinity Zone

T - Tidal Fresh
M - Mixing
S - Seawater
* - Salinity zone not present

Life Stage

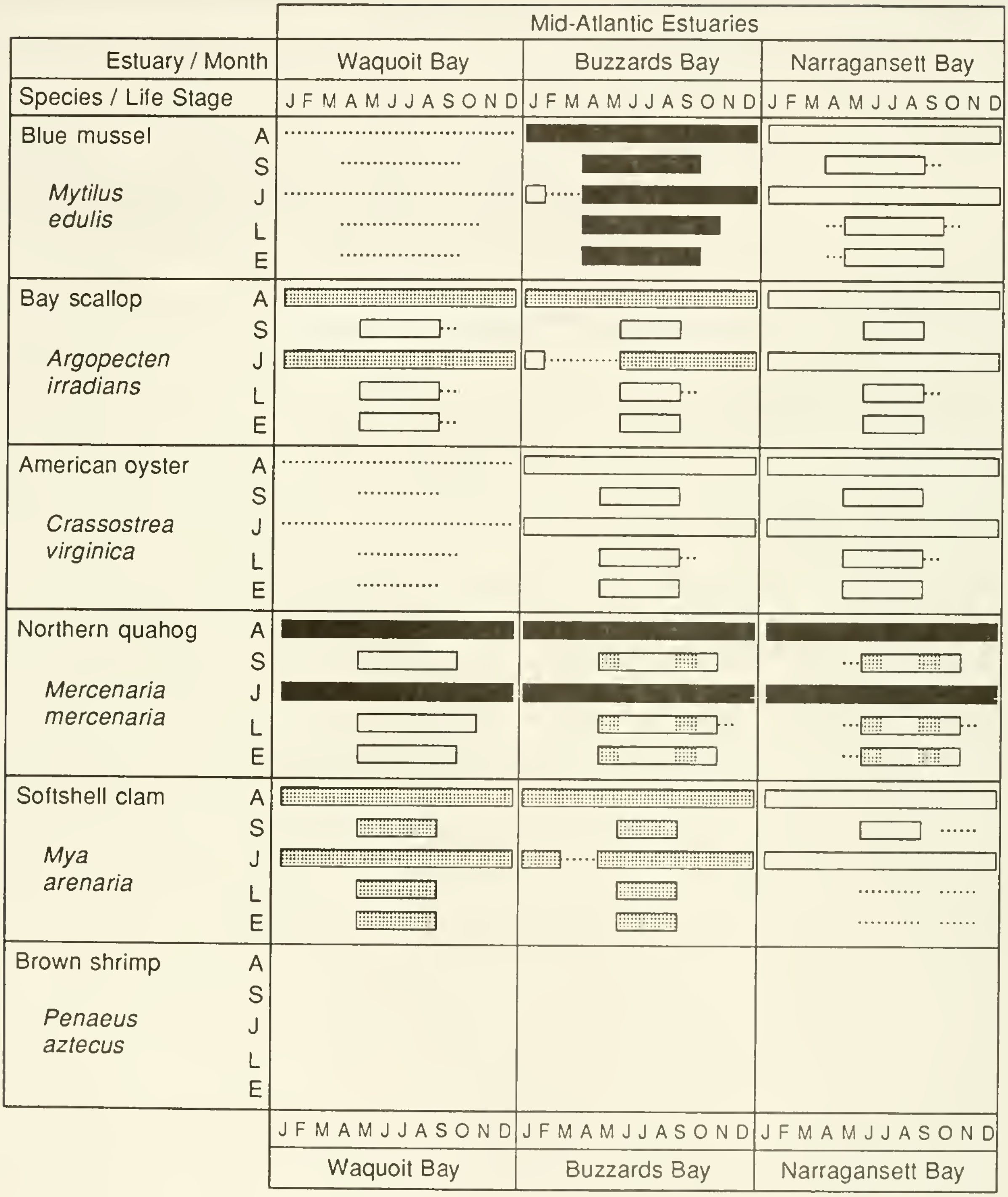
A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs

Table 5. Temporal distribution and relative abundance

Index to Table 5. Page location of temporal distribution table for each species and estuary.

	Waquoit Bay Buzzards Bay Narragansett Bay	Long Island Sound Connecticut River Gardiners Bay	Great South Bay Hudson River/Raritan Bay Barnegat Bay	New Jersey Inland Bays Delaware Bay Delaware Inland Bays	Chincoteague Bay Chesapeake Bay mainstem Chester River	Choptank River Patuxent River Potomac River	Tangier/Pocomoke Sound Rappahannock River	York River James River
Blue mussel (*Mytilus edulis*) Bay scallop (*Argopecten irradians*) American oyster (*Crassostrea virginica*) Northern quahog (*Mercenaria mercenaria*) Softshell clam (*Mya arenaria*) Brown shrimp (*Penaeus aztecus*)	p. 68	p. 69	p. 70	p. 71	p. 72	p. 73	p. 74	p. 75
Daggerblade grass shrimp (*Palaemonetes pugio*) Sevenspine bay shrimp (*Crangon septemspinosa*) American lobster (*Homarus americanus*) Blue crab (*Callinectes sapidus*) Skates (*Raja* species)	p. 76	p. 77	p. 78	p. 79	p. 80	p. 81	p. 82	p. 83
Atlantic stingray (*Dasyatis sabina*) Cownose ray (*Rhinoptera bonasus*) Shortnose sturgeon (*Acipenser brevirostrum*) Atlantic sturgeon (*Acipenser oxyrhynchus*) American eel (*Anguilla rostrata*) Blueback herring (*Alosa aestivalis*)	p. 84	p. 85	p. 86	p. 87	p. 88	p. 89	p. 90	p. 91
Alewife (*Alosa pseudoharengus*) American shad (*Alosa sapidissima*) Atlantic menhaden (*Brevoortia tyrannus*) Atlantic herring (*Clupea harengus*) Bay anchovy (*Anchoa mitchilli*) Channel catfish (*Ictalurus punctatus*)	p. 92	p. 93	p. 94	p. 95	p. 96	p. 97	p. 98	p. 99
Rainbow smelt (*Osmerus mordax*) Atlantic salmon (*Salmo salar*) Atlantic cod (*Gadus morhua*) Haddock (*Melanogrammus aeglefinus*) Atlantic tomcod (*Microgadus tomcod*) Pollock (*Pollachius virens*)	p. 100	p. 101	p. 102	p. 103	p. 104	p. 105	106	107
Red hake (*Urophycis chuss*) Oyster toadfish (*Opsanus tau*) Sheepshead minnow (*Cyprinodon variegatus*) Killifishes (*Fundulus* species) Silversides (*Menidia* species) Northern pipefish (*Syngnathus fuscus*)	p. 108	p. 109	p. 110	p. 111	p. 112	p. 113	114	115
Northern searobin (*Prionotus carolinus*) White perch (*Morone americana*) Striped bass (*Morone saxatilis*) Black sea bass (*Centropristis striata*) Yellow perch (*Perca flavescens*) Bluefish (*Pomatomus saltatrix*)	p. 116	p. 117	p. 118	p. 119	p. 120	p. 121	122	123
Pinfish (*Lagodon rhomboides*) Scup (*Stenotomus chrysops*) Spotted seatrout (*Cynoscion nebulosus*) Weakfish (*Cynoscion regalis*) Spot (*Leiostomus xanthurus*) Northern kingfish (*Menticirrhus saxatilis*)	p. 124	p. 125	p. 126	p. 127	p. 128	p. 129	130	131
Atlantic croaker (*Micropogonias undulatus*) Black drum (*Pogonias cromis*) Red drum (*Sciaenops ocellatus*) Mullets (*Mugil* species) Tautog (*Tautoga onitis*) Cunner (*Tautogolabrus adspersus*)	p. 132	p. 133	p. 134	p. 135	p. 136	p. 137	138	139
American sand lance (*Ammodytes americanus*) Gobies (*Gobiosoma* species) Atlantic mackerel (*Scomber scombrus*) Butterfish (*Peprilus triacanthus*)	p. 140	p. 141	p. 142	p. 143	p. 144	p. 145	146	147
Summer flounder (*Paralichthys dentatus*) Windowpane flounder (*Scophthalmus aquosus*) Winter flounder (*Pleuronectes americanus*) Hogchoker (*Trinectes maculatus*)	p. 148	p. 149	p. 150	p. 151	p. 152	p. 153	154	155

Table 5. Temporal distribution



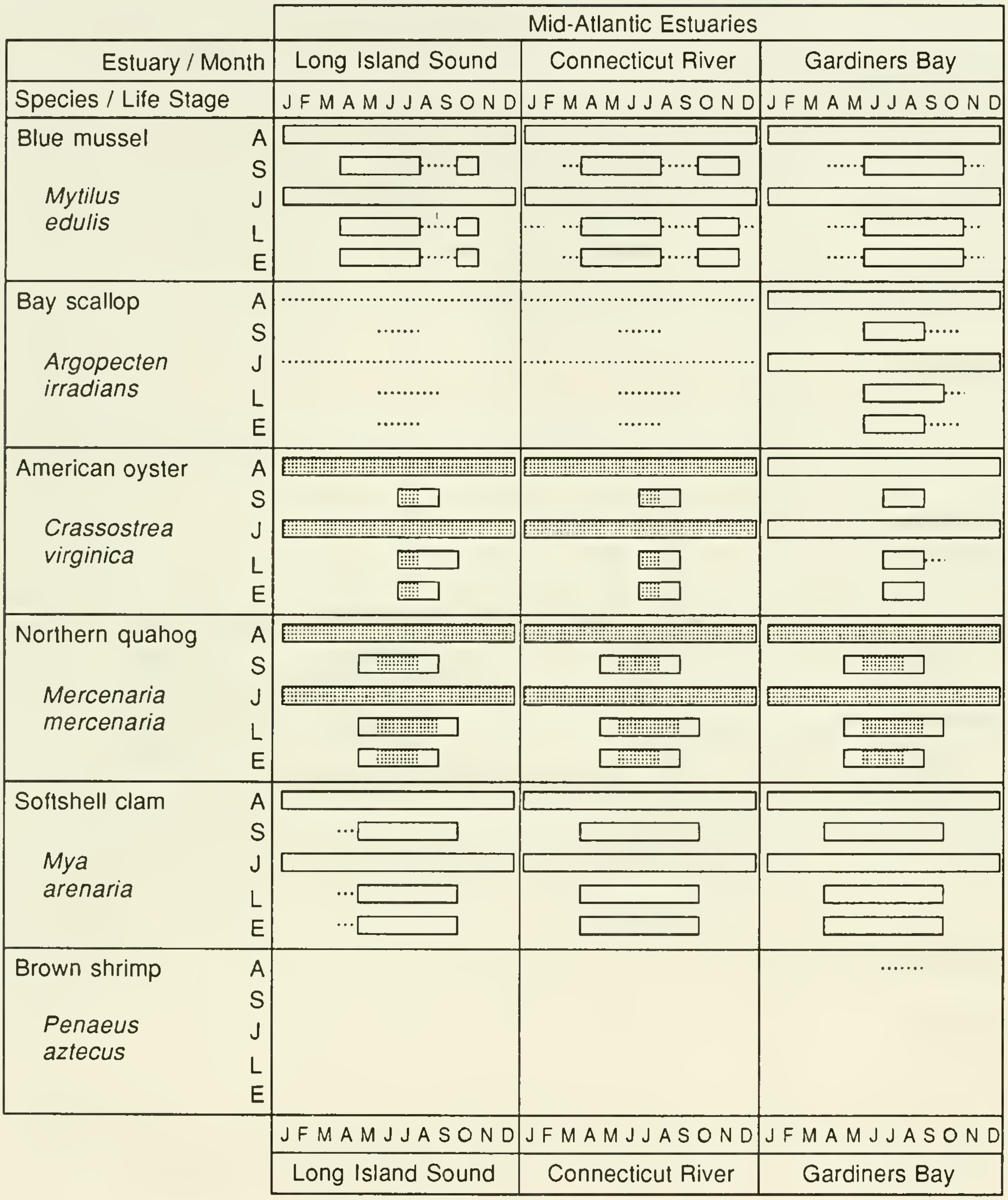
Relative Abundance

█ Highly Abundant
▨ Abundant
▭ Common
········ Rare
Blank Not Present

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs

Table 5, continued. Temporal distribution



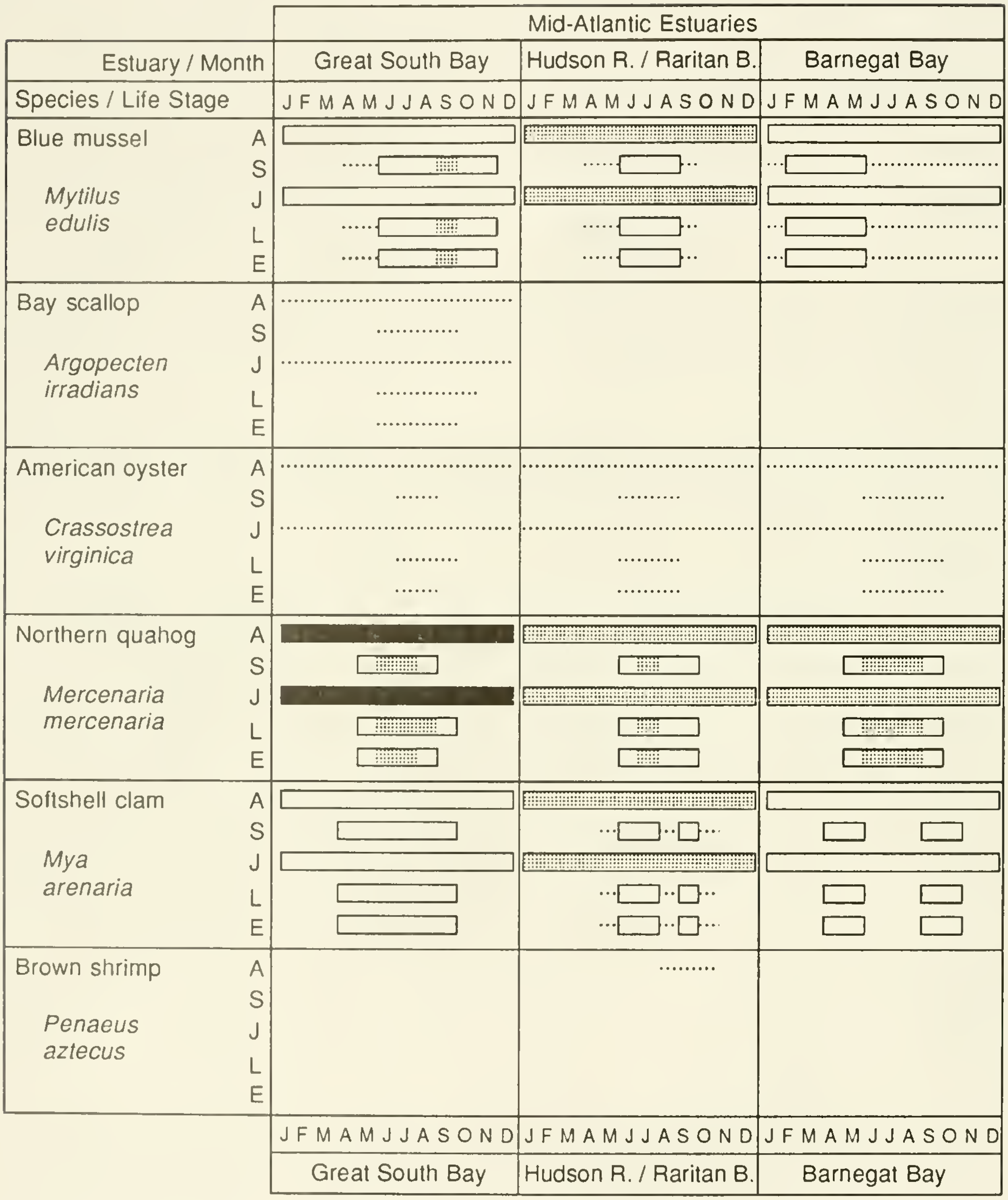
Relative Abundance

■	Highly Abundant
▨	Abundant
☐	Common
········	Rare
Blank	Not Present

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs

Table 5, continued. Temporal distribution

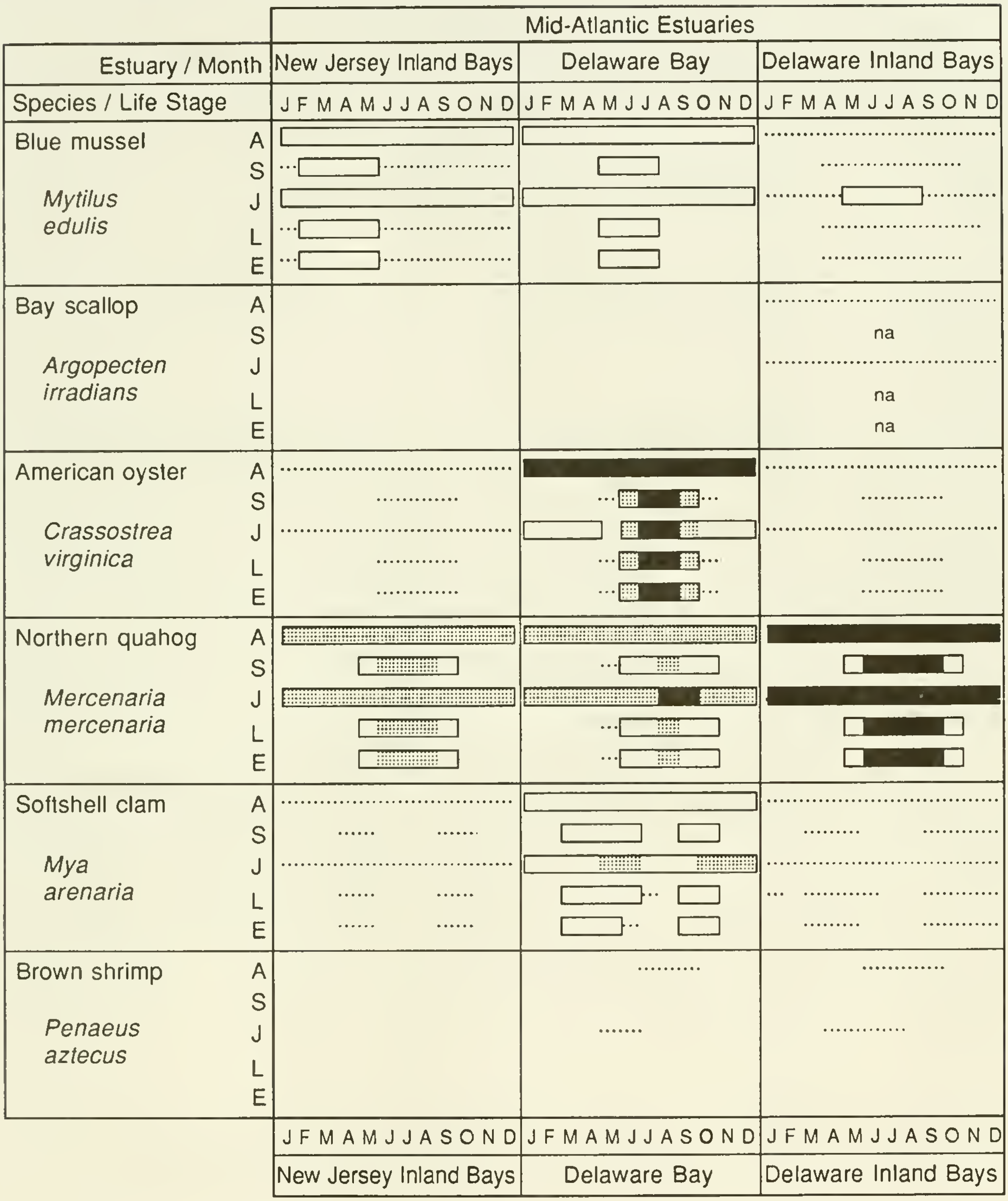


Relative Abundance	
■	Highly Abundant
▨	Abundant
▭	Common
········	Rare
Blank	Not Present

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs

Table 5, continued. Temporal distribution



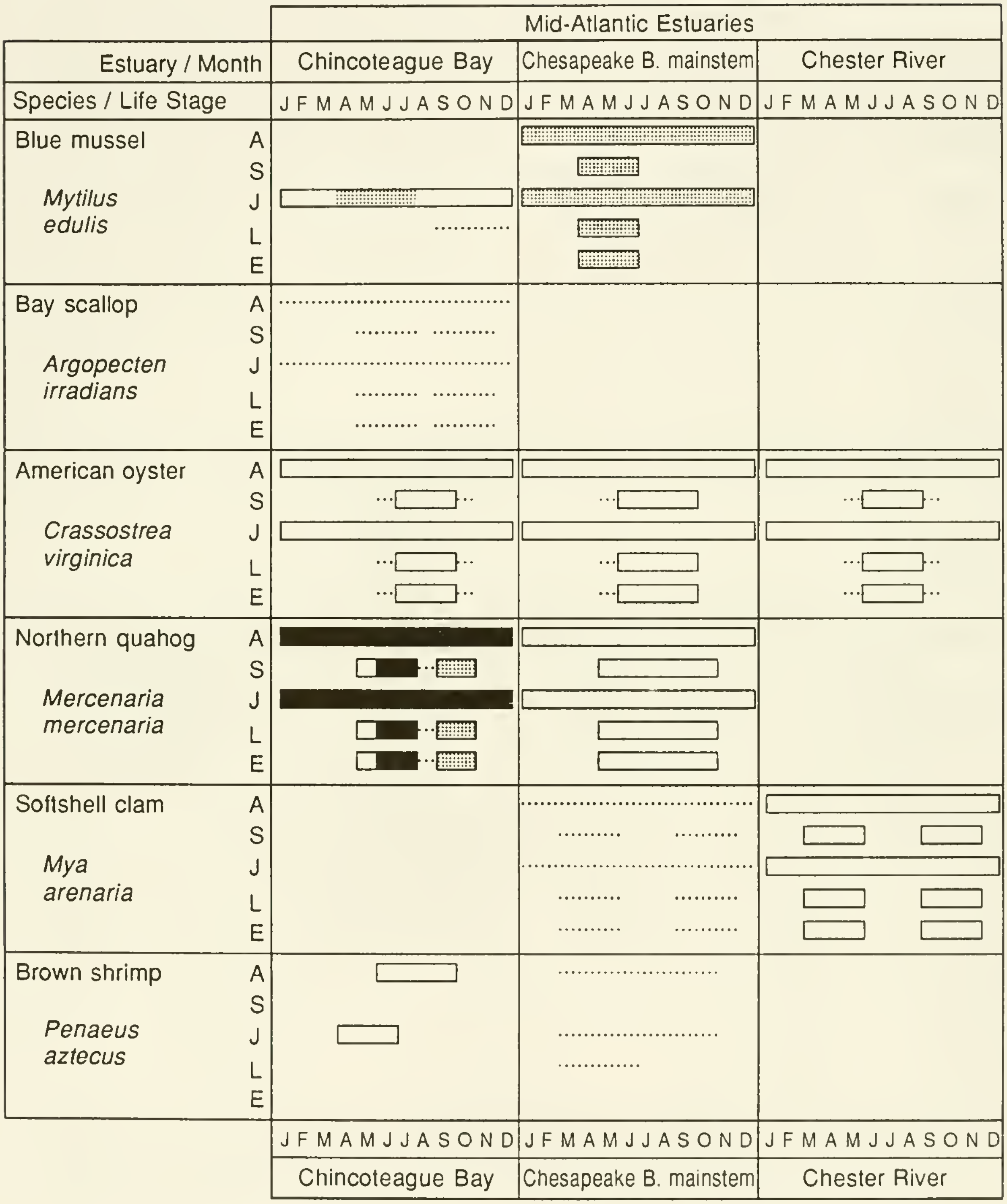
Relative Abundance

- ■ Highly Abundant
- ▨ Abundant
- □ Common
- ········ Rare
- Blank Not Present
- na No Data Available

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs

Table 5, continued. Temporal distribution



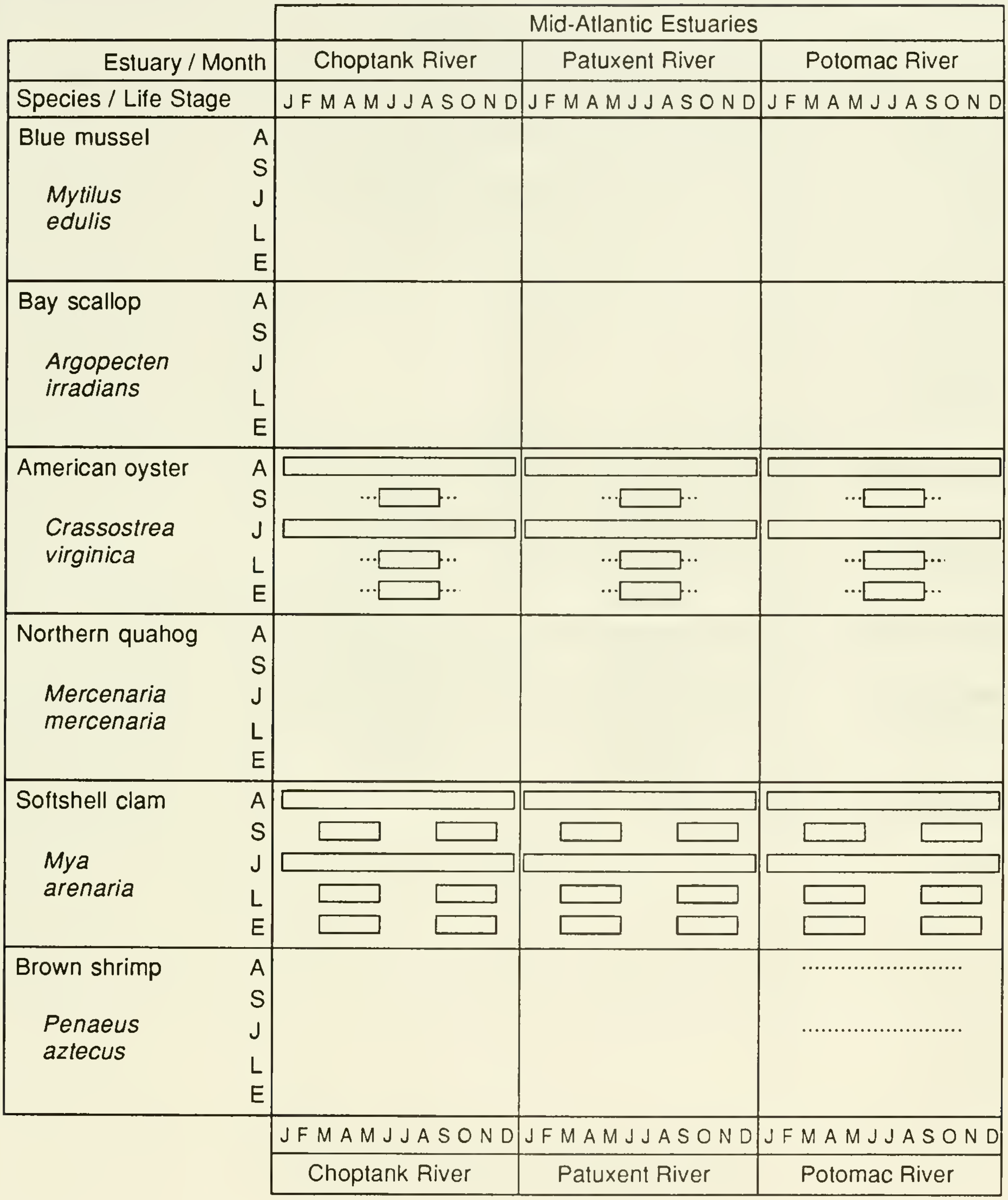
Relative Abundance

■	Highly Abundant
▨	Abundant
▭	Common
....	Rare
Blank	Not Present

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs

Table 5, continued. Temporal distribution



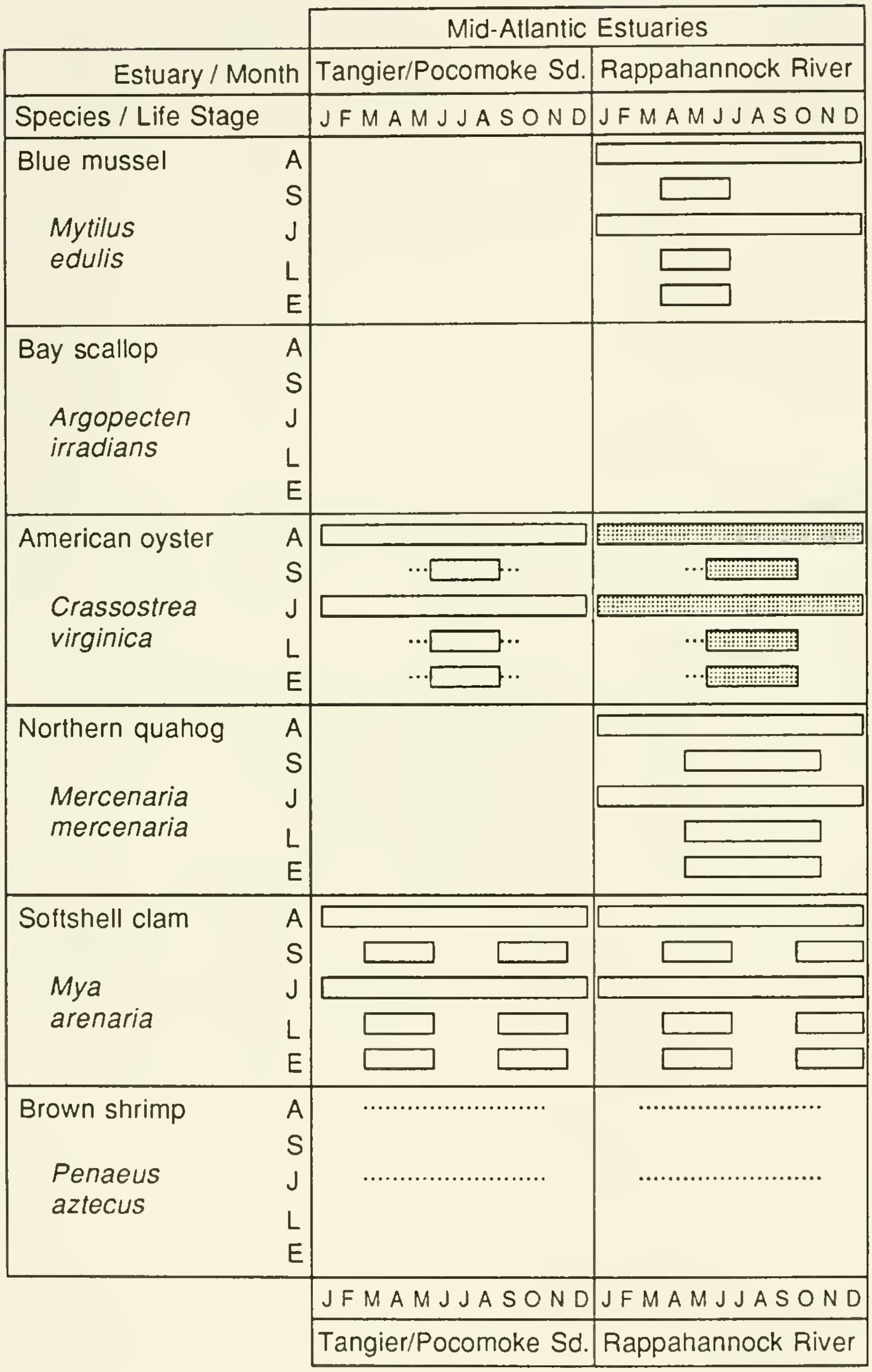
Relative Abundance

■	Highly Abundant
▨	Abundant
▭	Common
········	Rare
Blank	Not Present

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs

Table 5, continued. Temporal distribution



Relative Abundance

■	Highly Abundant
▨	Abundant
□	Common
········	Rare
Blank	Not Present

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs

Table 5, continued. Temporal distribution

		Mid-Atlantic Estuaries																							
Estuary / Month		York River												James River											
Species / Life Stage		J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
Blue mussel *Mytilus edulis*	A	▭	▭	▭	▭	▭	▭	▭	▭	▭	▭	▭	▭	▭	▭	▭	▭	▭	▭	▭	▭	▭	▭	▭	▭
	S				▭	▭	▭										▭	▭	▭						
	J	▭	▭	▭	▭	▭	▭	▭	▭	▭	▭	▭	▭	▭	▭	▭	▭	▭	▭	▭	▭	▭	▭	▭	▭
	L				▭	▭	▭										▭	▭	▭						
	E				▭	▭	▭										▭	▭	▭						
Bay scallop *Argopecten irradians*	A																								
	S																								
	J																								
	L																								
	E																								
American oyster *Crassostrea virginica*	A	▭	▭	▭	▭	▭	▭	▭	▭	▭	▭	▭	▭	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨
	S					▭	▭	▭	▭	▭								···	▨	▨	▨	▨			
	J	▭	▭	▭	▭	▭	▭	▭	▭	▭	▭	▭	▭	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨
	L					▭	▭	▭	▭	▭								···	▨	▨	▨	▨			
	E					▭	▭	▭	▭	▭								···	▨	▨	▨	▨			
Northern quahog *Mercenaria mercenaria*	A	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨
	S					▨	▨	▨	▨	▨	▨							▨	▨	▨	▨	▨	▨		
	J	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨
	L					▨	▨	▨	▨	▨	▨							▨	▨	▨	▨	▨	▨		
	E					▨	▨	▨	▨	▨	▨							▨	▨	▨	▨	▨	▨		
Softshell clam *Mya arenaria*	A	···	···	···	···	···	···	···	···	···	···	···	···	···	···	···	···	···	···	···	···	···	···	···	···
	S				···	···	···				···	···	···				···	···	···				···	···	···
	J	···	···	···	···	···	···	···	···	···	···	···	···	···	···	···	···	···	···	···	···	···	···	···	···
	L				···	···	···				···	···	···				···	···	···				···	···	···
	E				···	···	···				···	···	···				···	···	···				···	···	···
Brown shrimp *Penaeus aztecus*	A			···	···	···	···	···	···	···	···					···	···	···	···	···	···	···	···		
	S																								
	J			···	···	···	···	···	···	···	···					···	···	···	···	···	···	···	···		
	L																								
	E																								
		J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
		York River												James River											

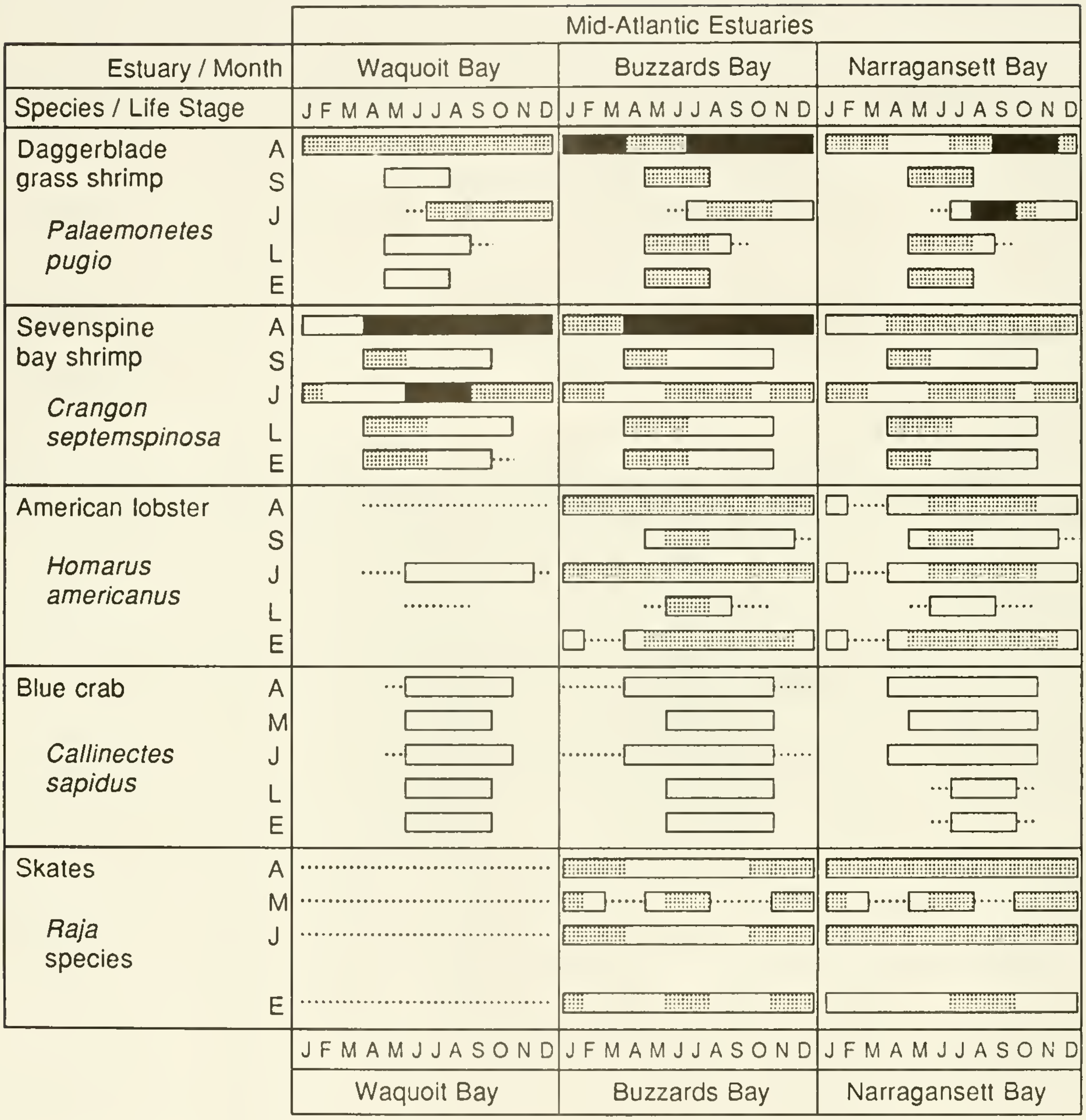
Relative Abundance

■	Highly Abundant
▨	Abundant
▭	Common
·········	Rare
Blank	Not Present

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs

Table 5, continued. Temporal distribution



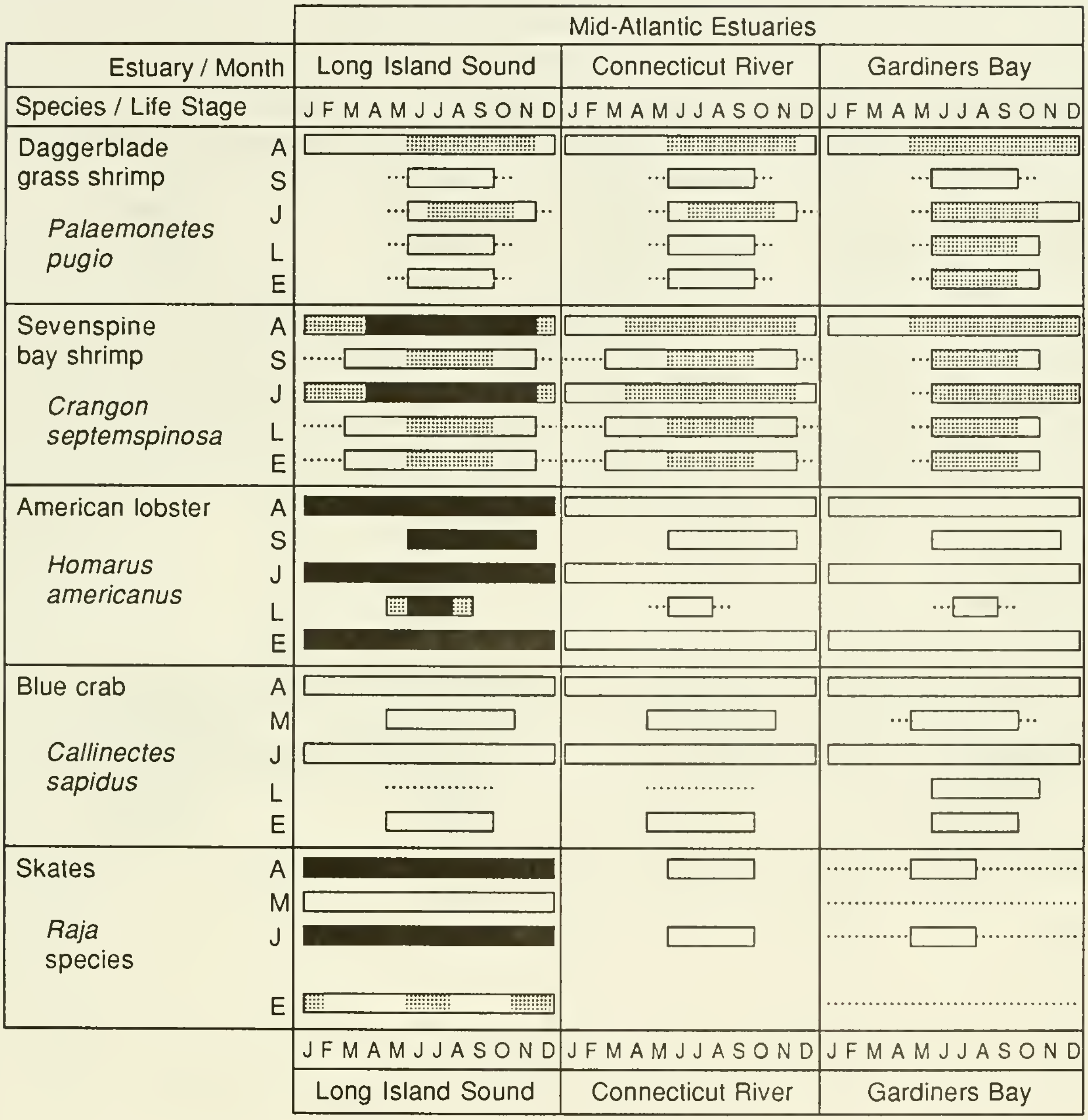
Relative Abundance

■	Highly Abundant
▨	Abundant
☐	Common
....	Rare
Blank	Not Present

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs
M - Mating

Table 5, continued. Temporal distribution



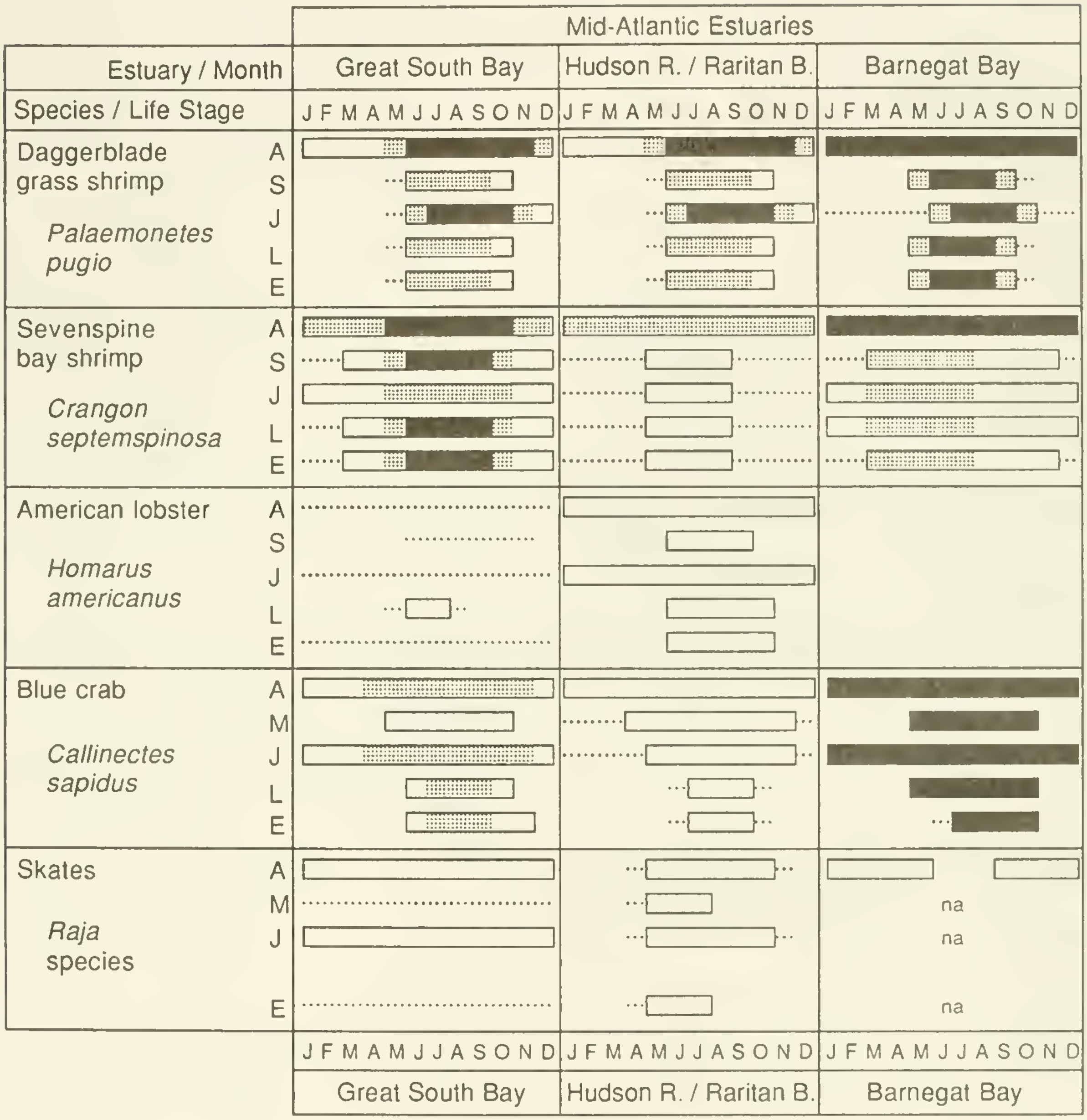
Relative Abundance

■	Highly Abundant
▨	Abundant
☐	Common
………	Rare
Blank	Not Present

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs
M - Mating

Table 5, continued. Temporal distribution



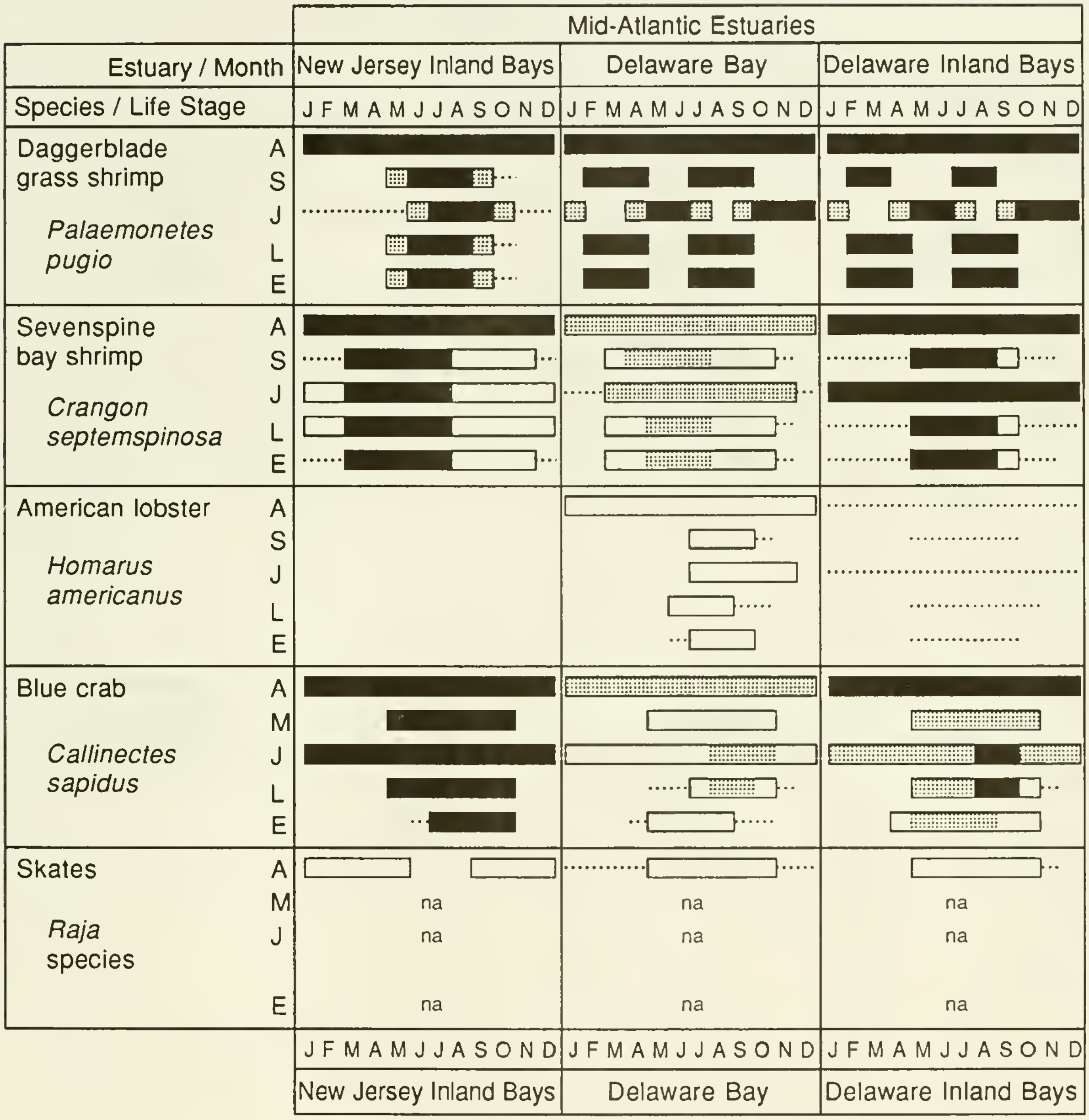
Relative Abundance

■ Highly Abundant
▨ Abundant
□ Common
········ Rare
Blank Not Present
na No Data Available

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs
M - Mating

Table 5, continued. Temporal distribution



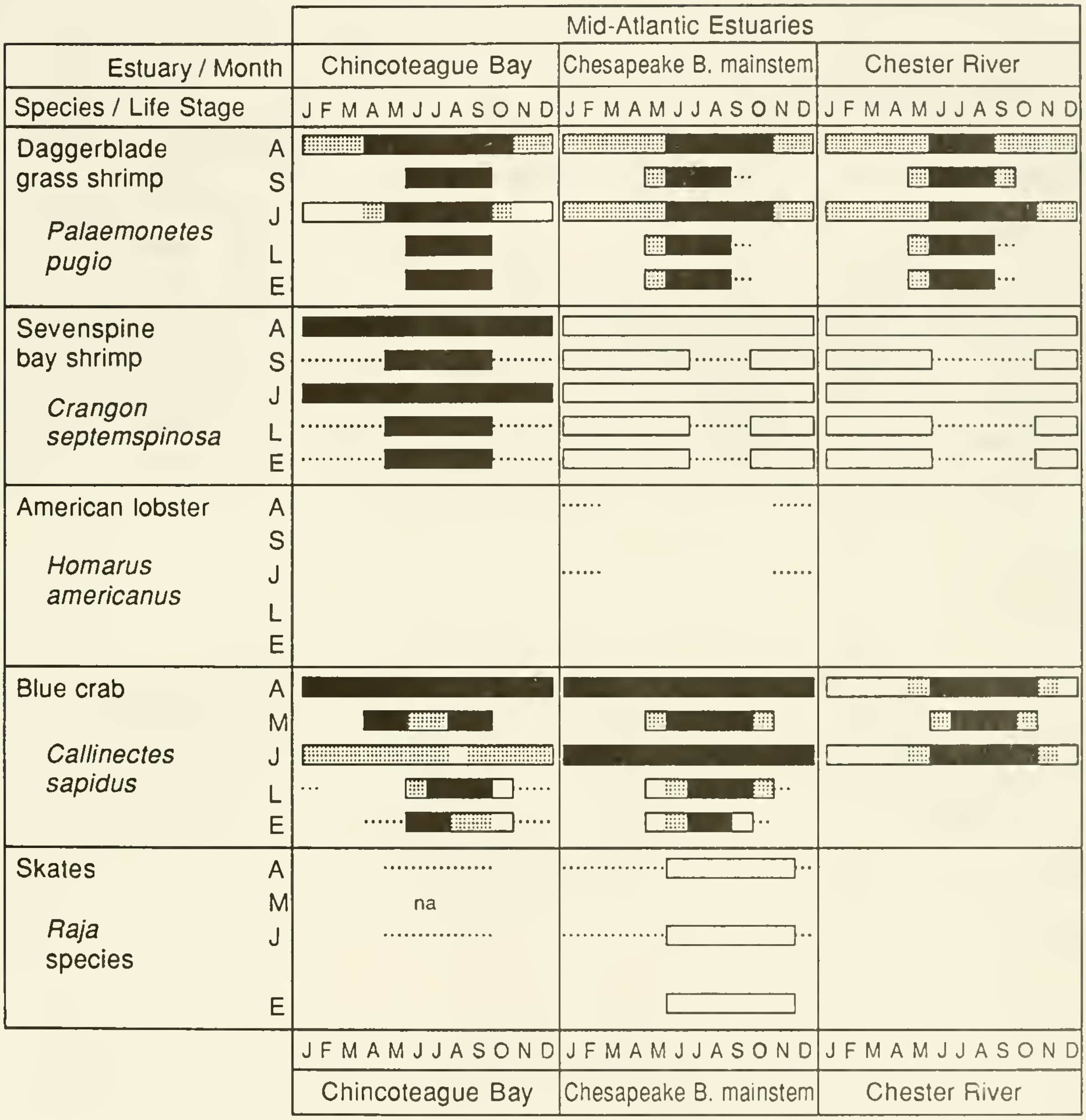
Relative Abundance

■	Highly Abundant
▨	Abundant
☐	Common
········	Rare
Blank	Not Present
na	No Data Available

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs
M - Mating

Table 5, continued. Temporal distribution



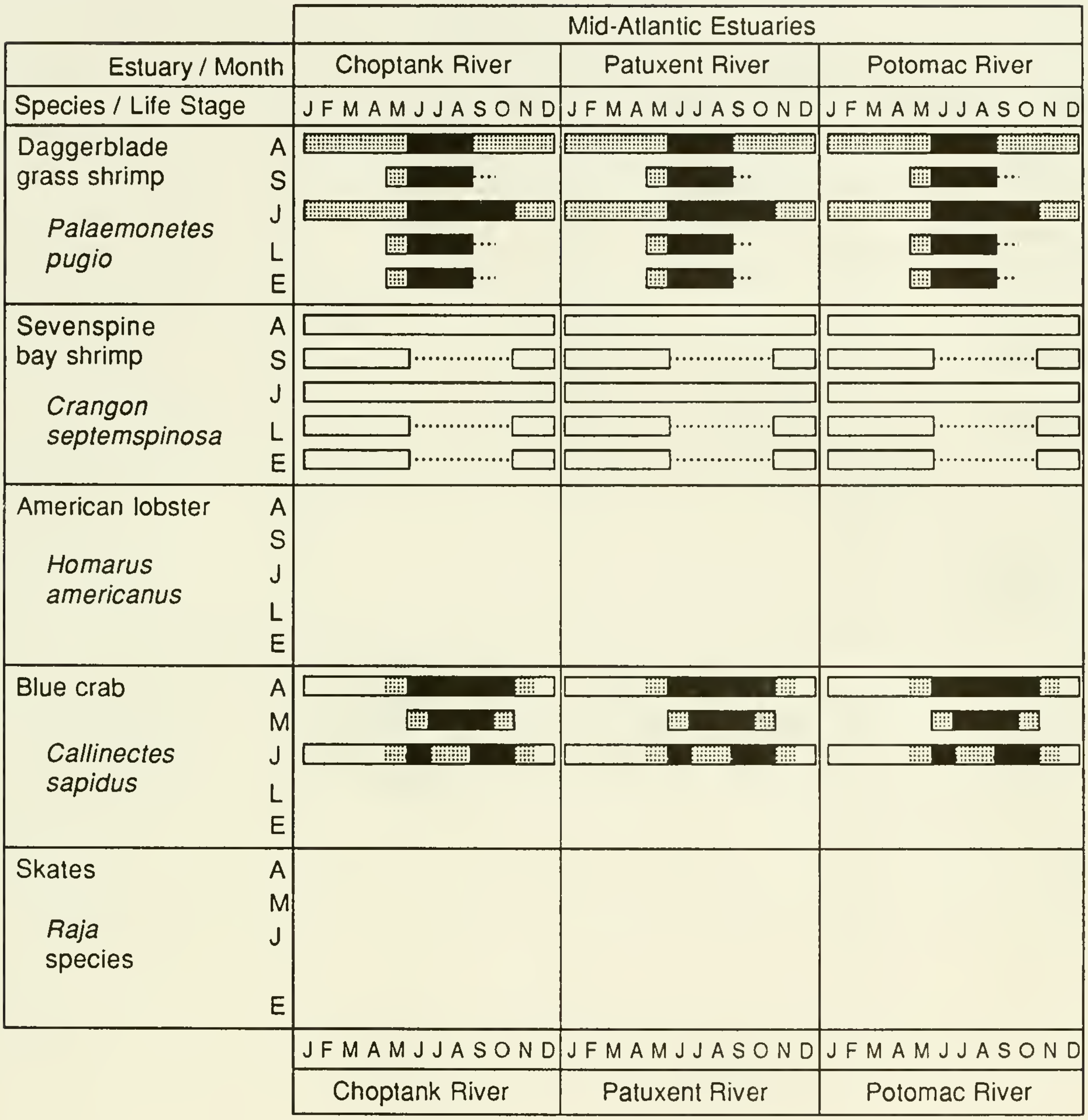
Relative Abundance

■	Highly Abundant
▨	Abundant
☐	Common
········	Rare
Blank	Not Present
na	No Data Available

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs
M - Mating

Table 5, continued. Temporal distribution

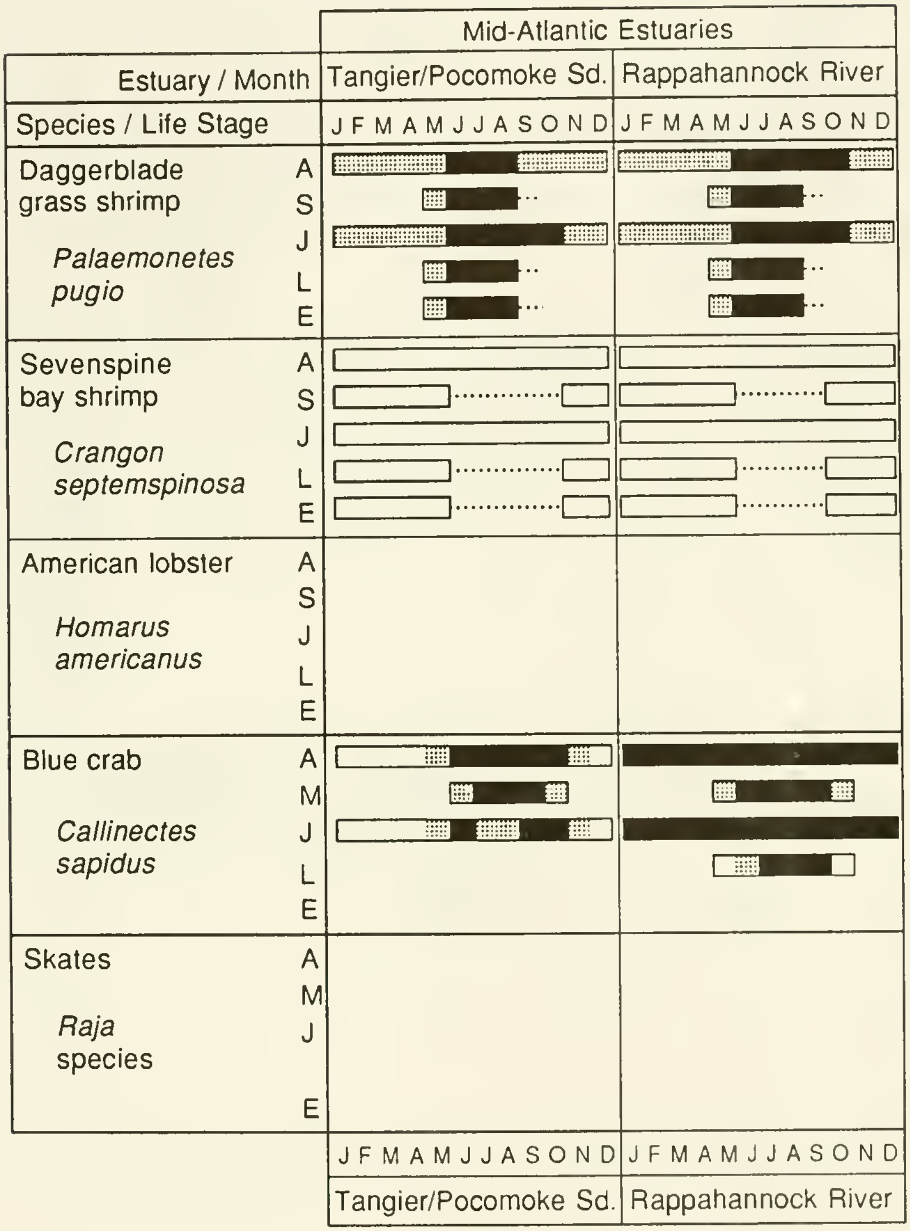


Relative Abundance	
■	Highly Abundant
▨	Abundant
▭	Common
········	Rare
Blank	Not Present

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs
M - Mating

Table 5, continued. Temporal distribution



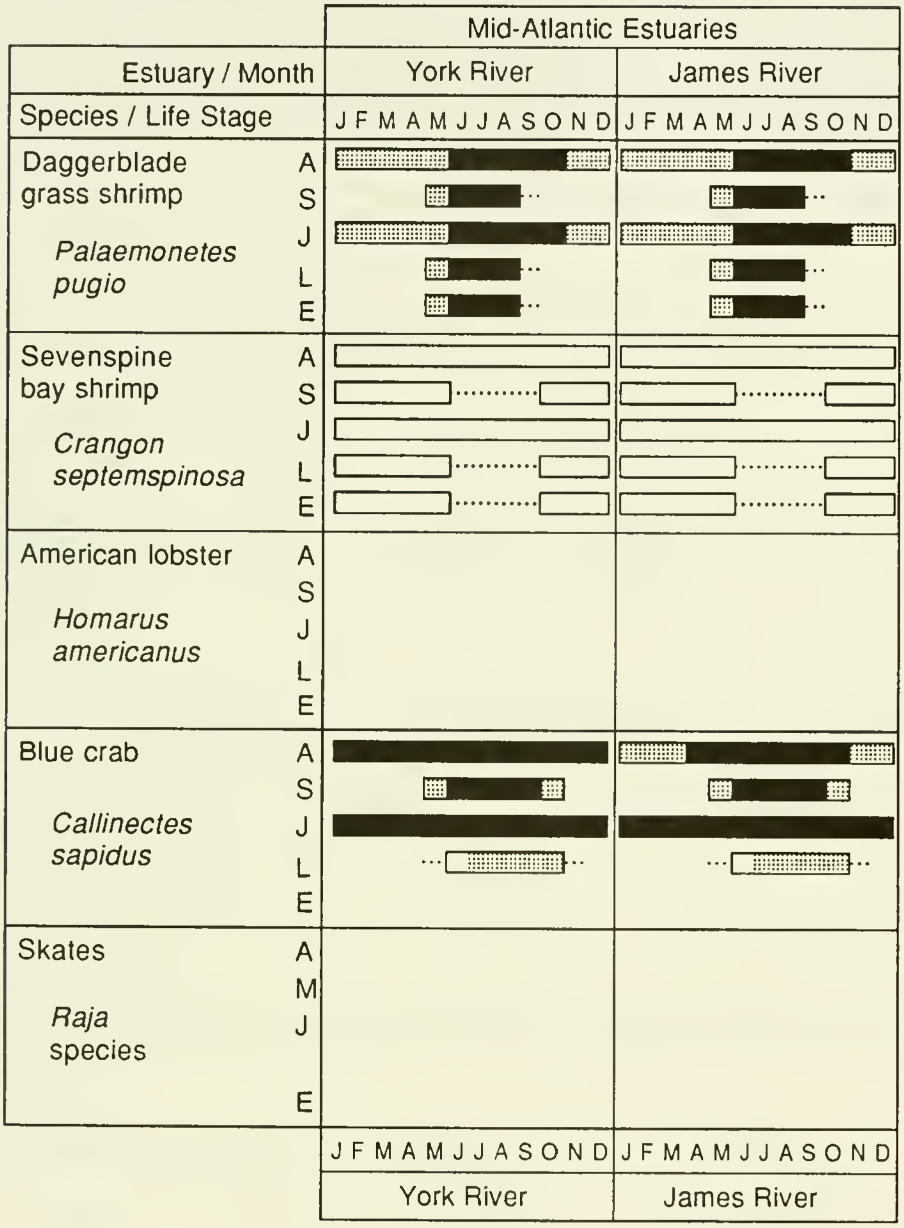
Relative Abundance

- ■ Highly Abundant
- ▨ Abundant
- □ Common
- ⋯⋯ Rare
- Blank Not Present

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs
M - Mating

Table 5, continued. Temporal distribution



Relative Abundance

■ Highly Abundant

▨ Abundant

☐ Common

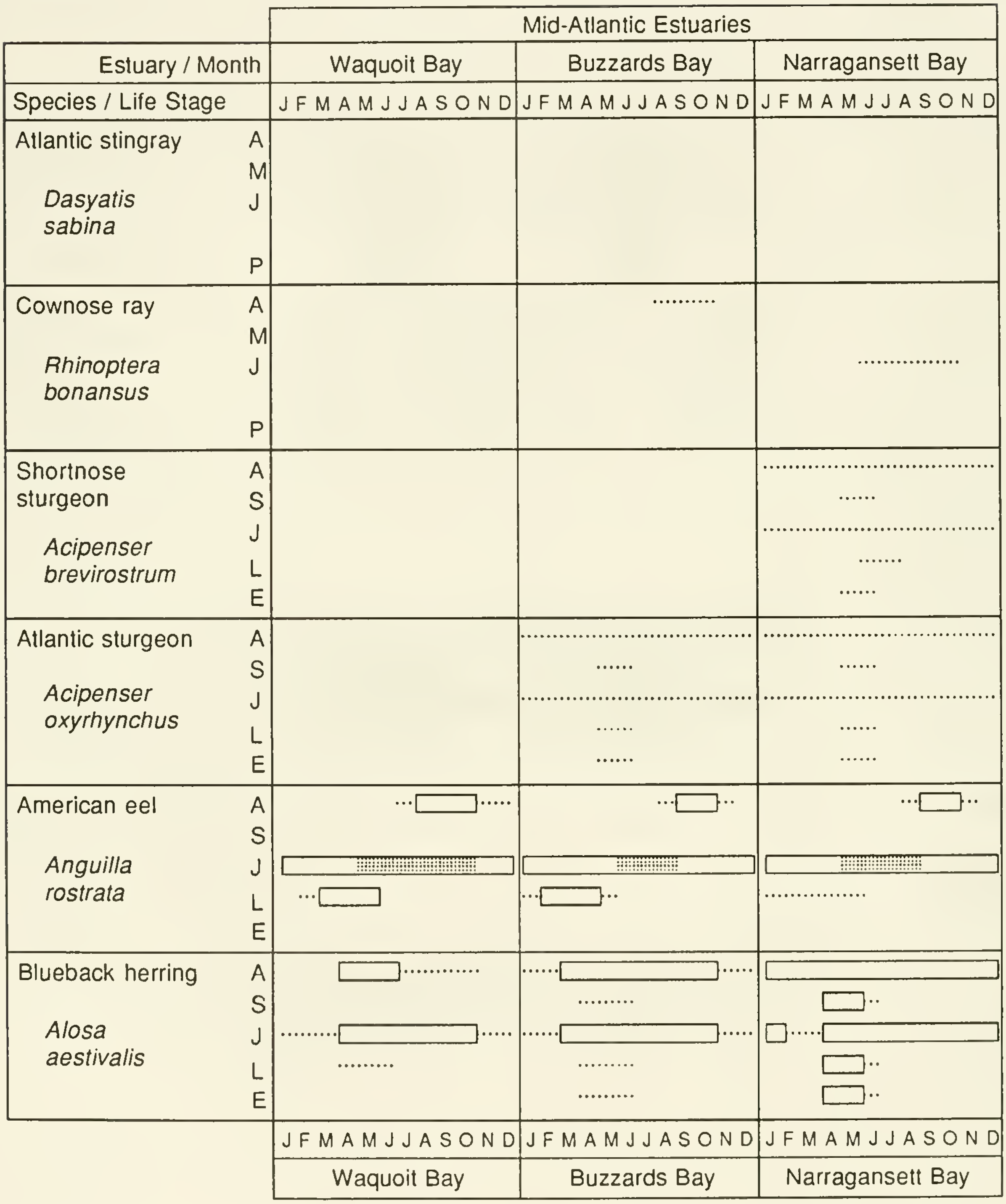
········ Rare

Blank Not Present

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs
M - Mating

Table 5, continued. Temporal distribution



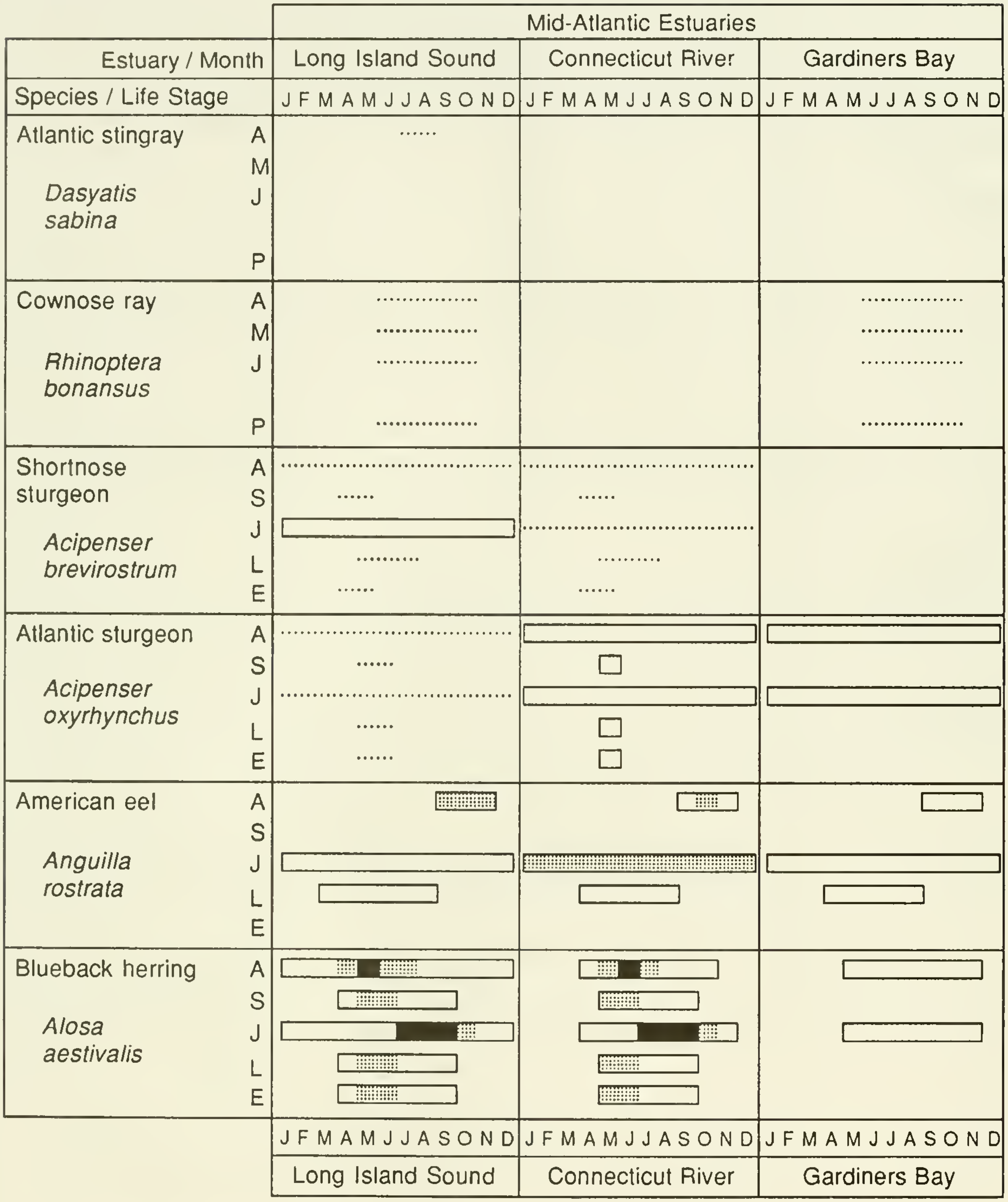
Relative Abundance

■	Highly Abundant
▨	Abundant
☐	Common
………	Rare
Blank	Not Present

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs
M - Mating
P - Parturition

Table 5, continued. Temporal distribution



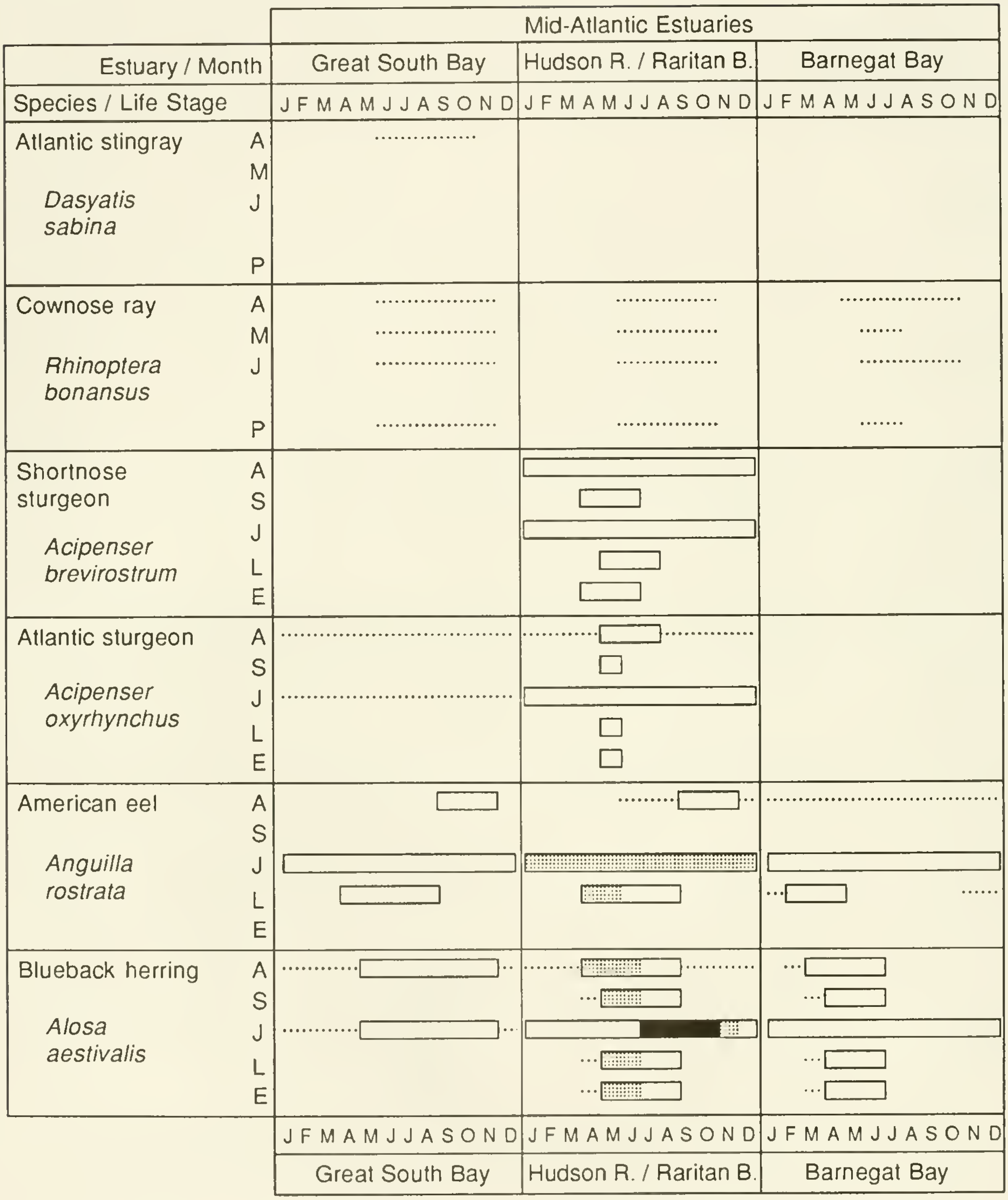
Relative Abundance

■	Highly Abundant
▨	Abundant
☐	Common
········	Rare
Blank	Not Present

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs
M - Mating
P - Parturition

Table 5, continued. Temporal distribution



Relative Abundance

■ Highly Abundant

▨ Abundant

☐ Common

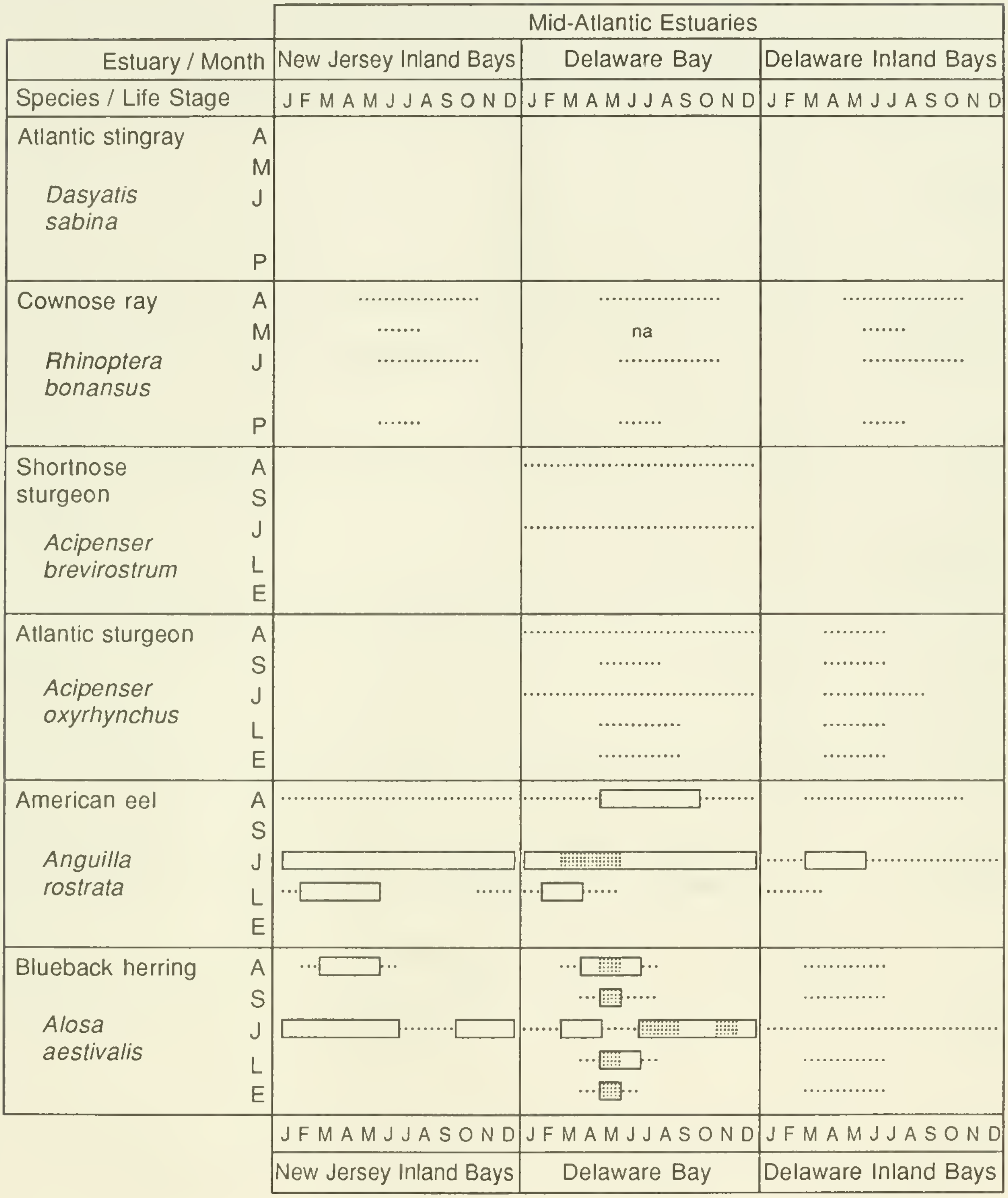
········ Rare

Blank Not Present

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs
M - Mating
P - Parturition

Table 5, continued. Temporal distribution



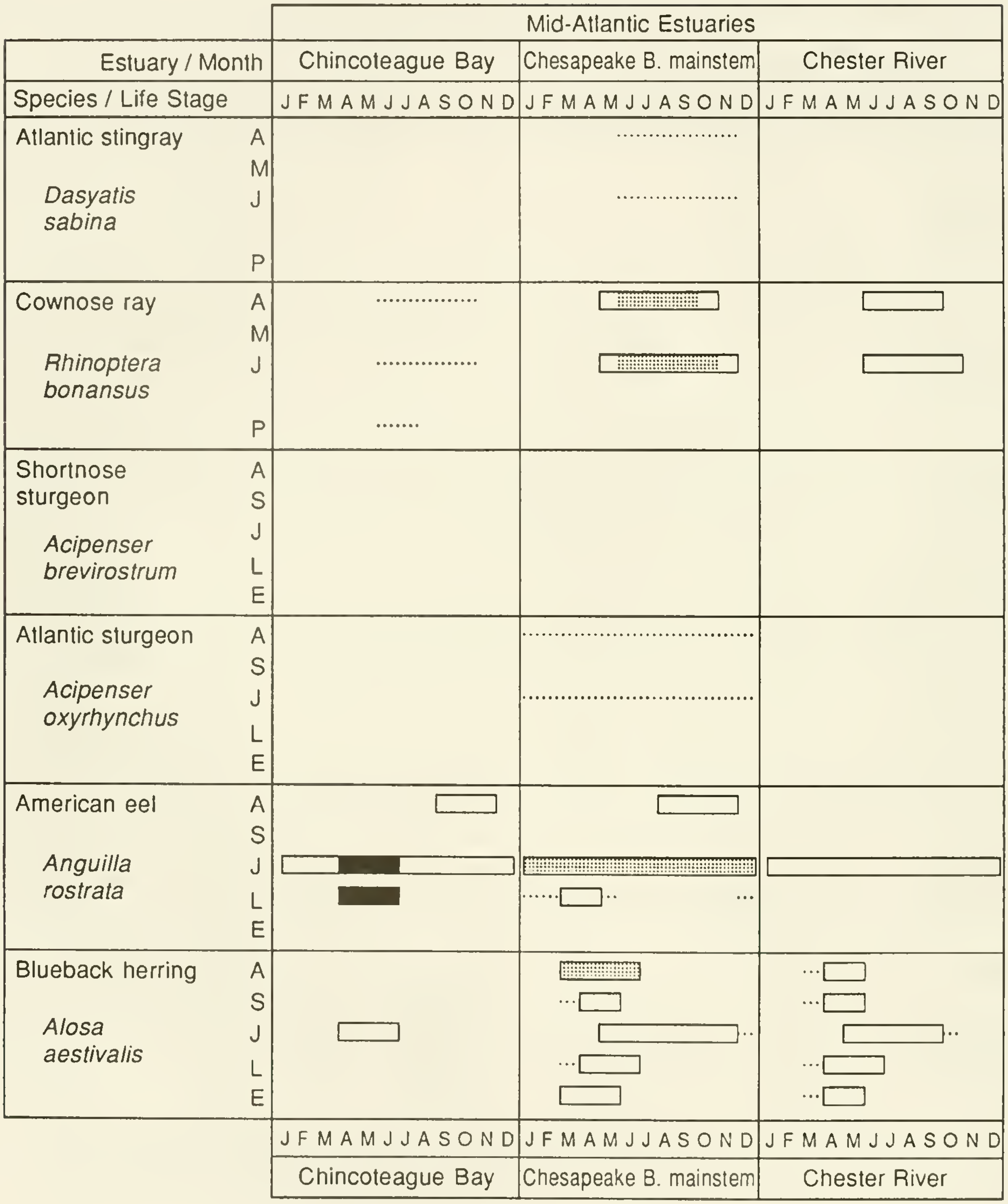
Relative Abundance

■	Highly Abundant
▨	Abundant
☐	Common
········	Rare
Blank	Not Present
na	No Data Available

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs
M - Mating
P - Parturition

Table 5, continued. Temporal distribution

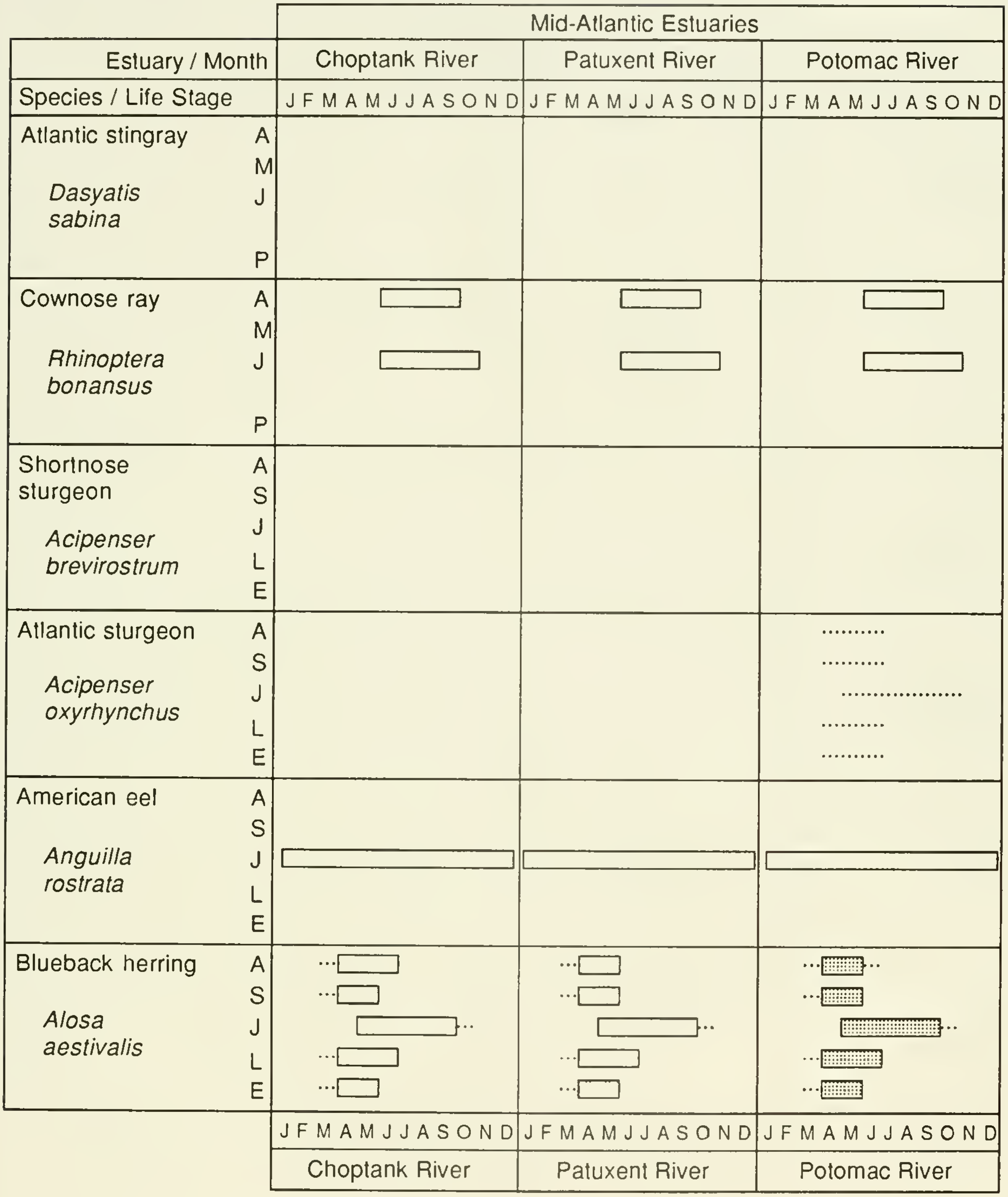


Relative Abundance	
■	Highly Abundant
▨	Abundant
☐	Common
....	Rare
Blank	Not Present

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs
M - Mating
P - Parturition

Table 5, continued. Temporal distribution



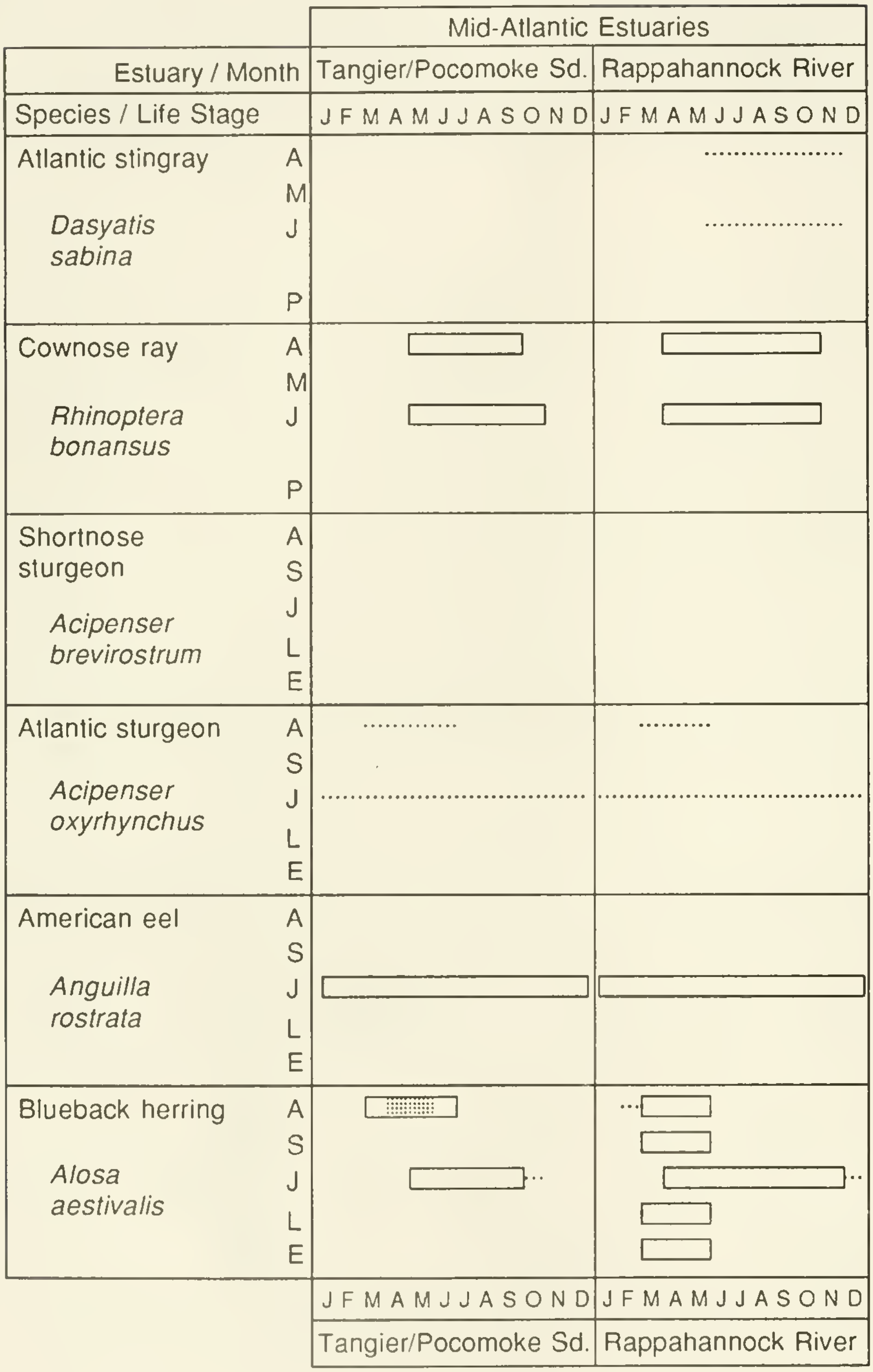
Relative Abundance

■	Highly Abundant
▨	Abundant
▭	Common
....	Rare
Blank	Not Present

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs
M - Mating
P - Parturition

Table 5, continued. Temporal distribution

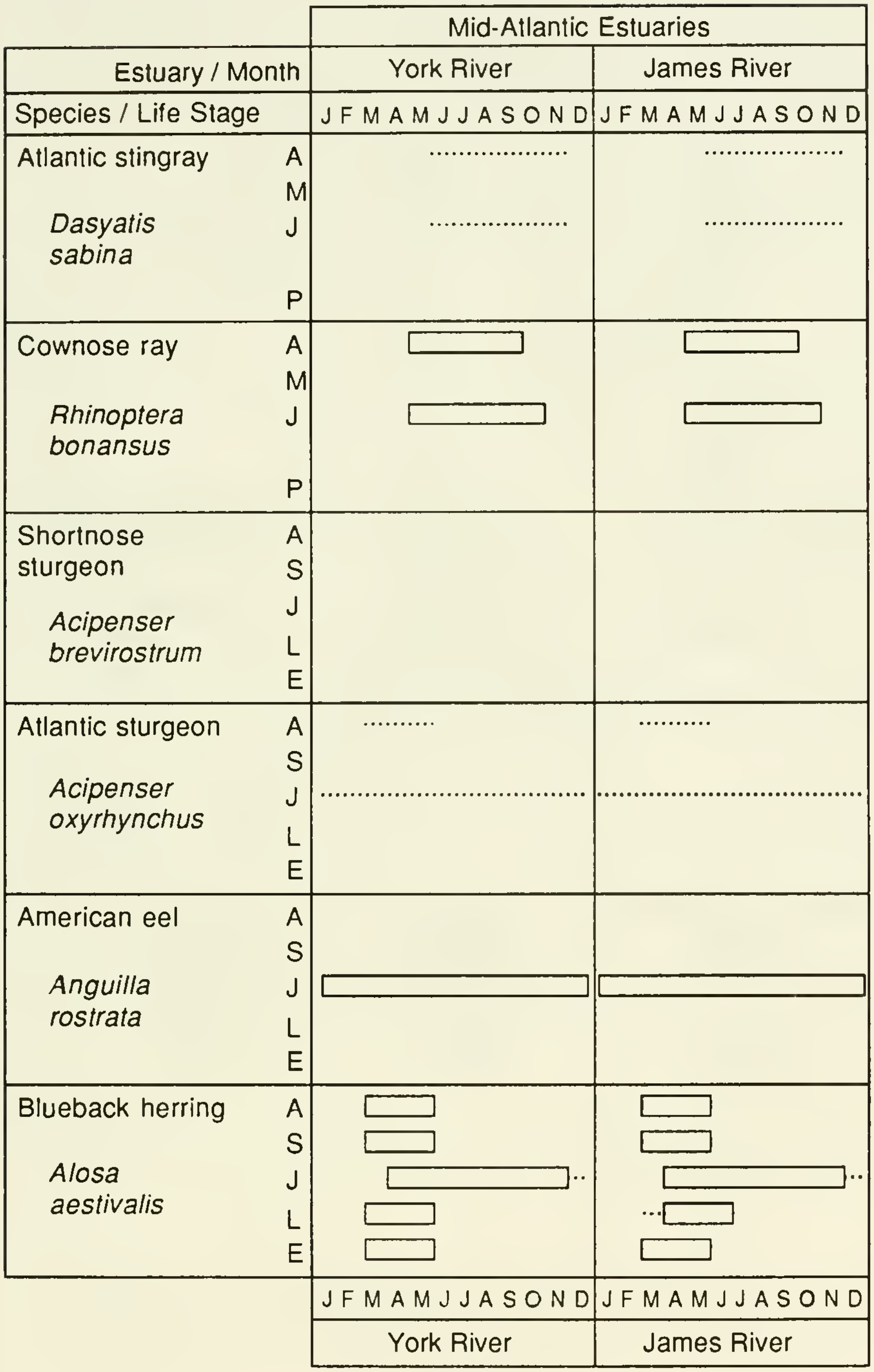


Relative Abundance	
■	Highly Abundant
▨	Abundant
☐	Common
....	Rare
Blank	Not Present

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs
M - Mating
P - Parturition

Table 5, continued. Temporal distribution



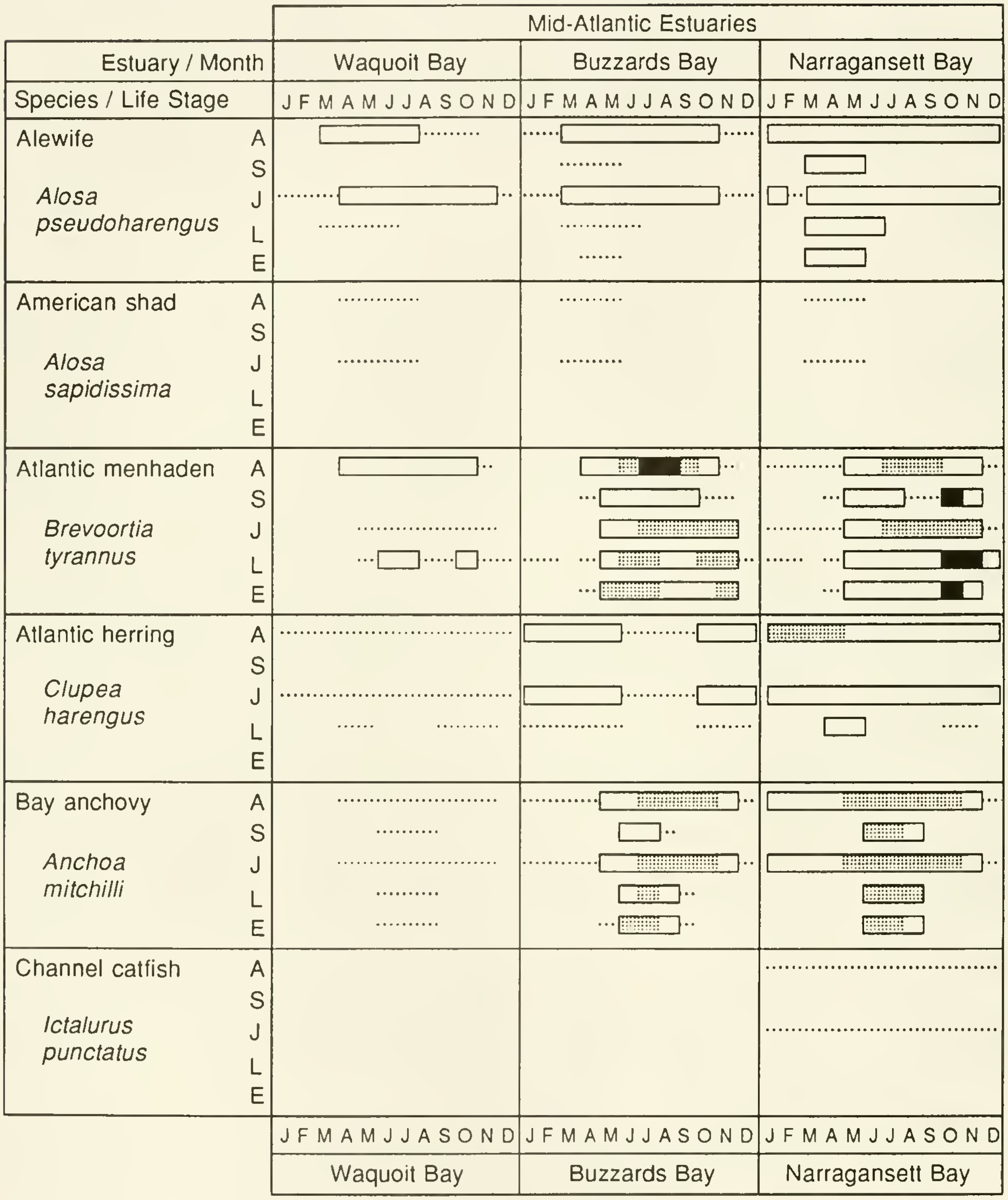
Relative Abundance

■	Highly Abundant
▨	Abundant
▭	Common
········	Rare
Blank	Not Present

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs
M - Mating
P - Parturition

Table 5, continued. Temporal distribution



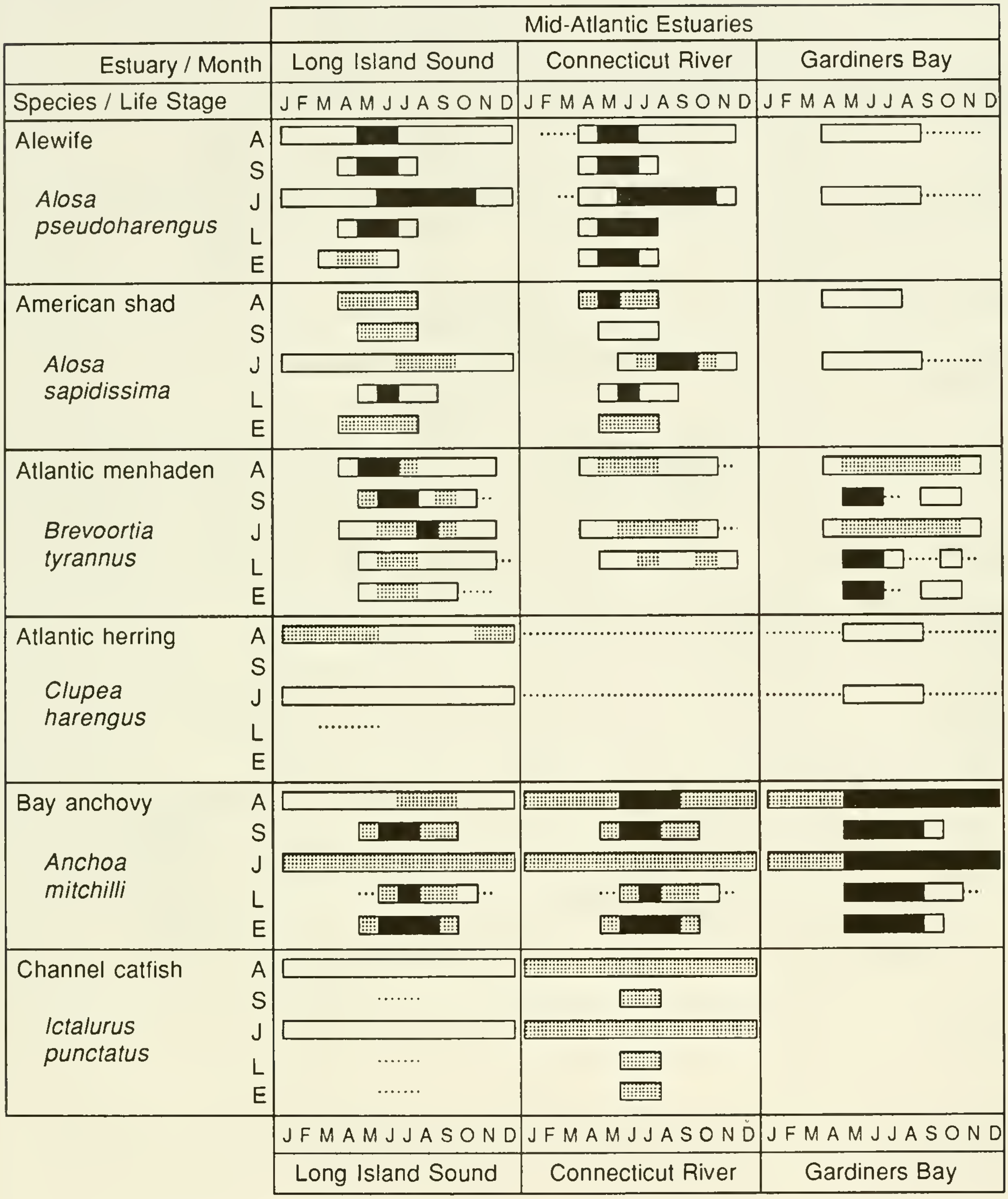
Relative Abundance

■	Highly Abundant
▨	Abundant
☐	Common
·········	Rare
Blank	Not Present

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs

Table 5, continued. Temporal distribution



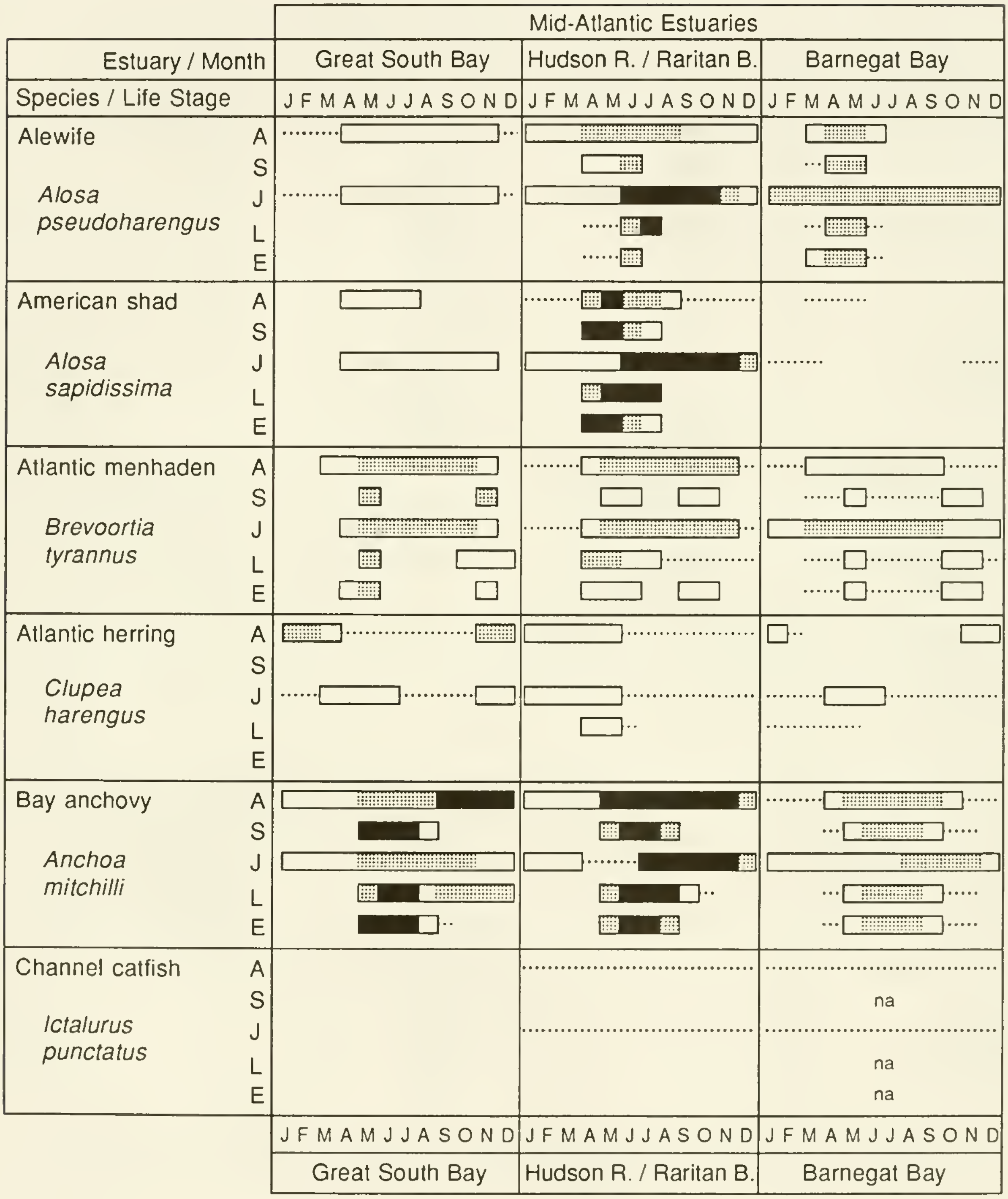
Relative Abundance

■	Highly Abundant
▨	Abundant
☐	Common
········	Rare
Blank	Not Present

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs

Table 5, continued. Temporal distribution



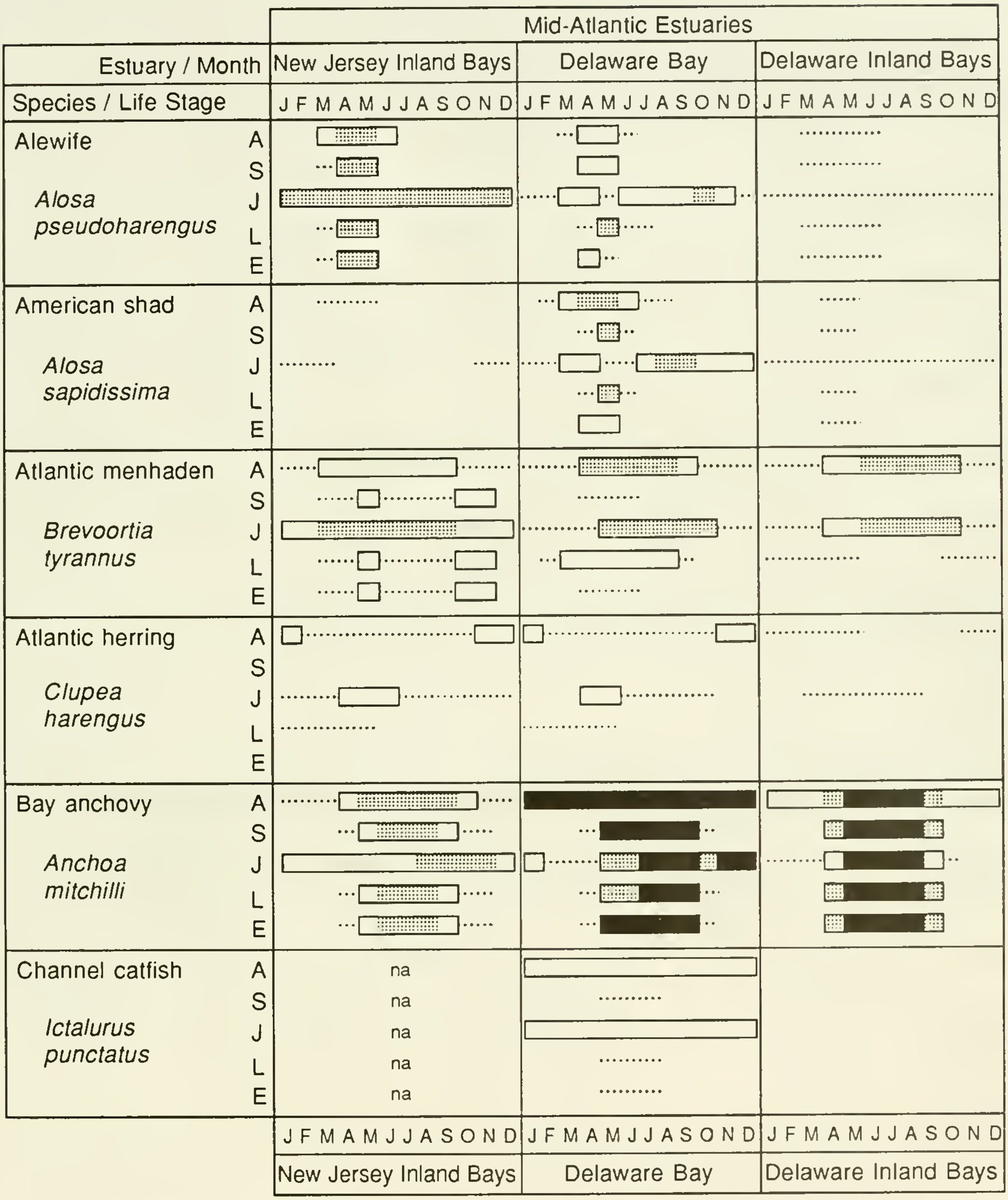
Relative Abundance

■	Highly Abundant
▨	Abundant
☐	Common
....	Rare
Blank	Not Present
na	No Data Available

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs

Table 5, continued. Temporal distribution



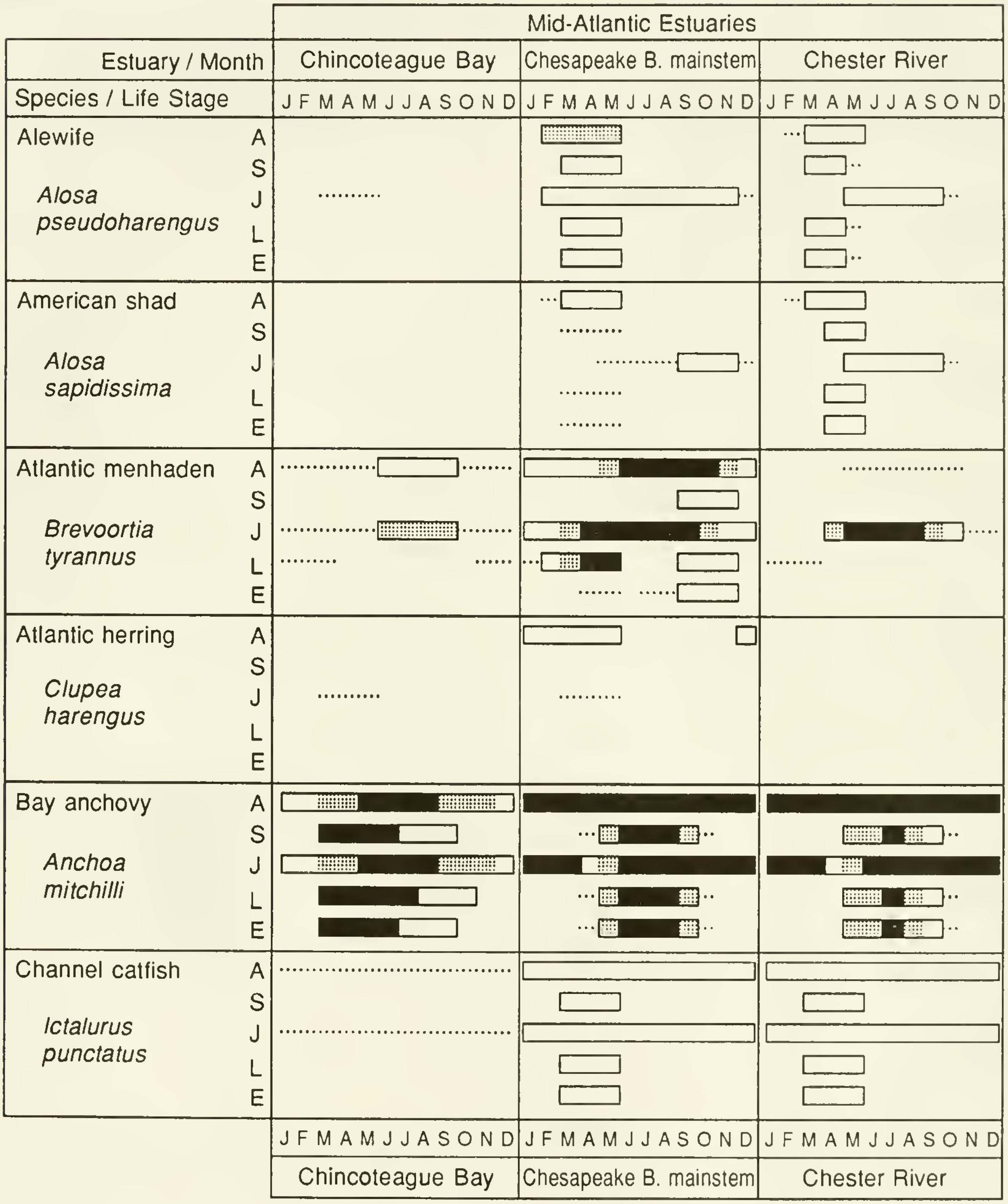
Relative Abundance

■	Highly Abundant
▨	Abundant
☐	Common
········	Rare
Blank	Not Present
na	No Data Available

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs

Table 5, continued. Temporal distribution



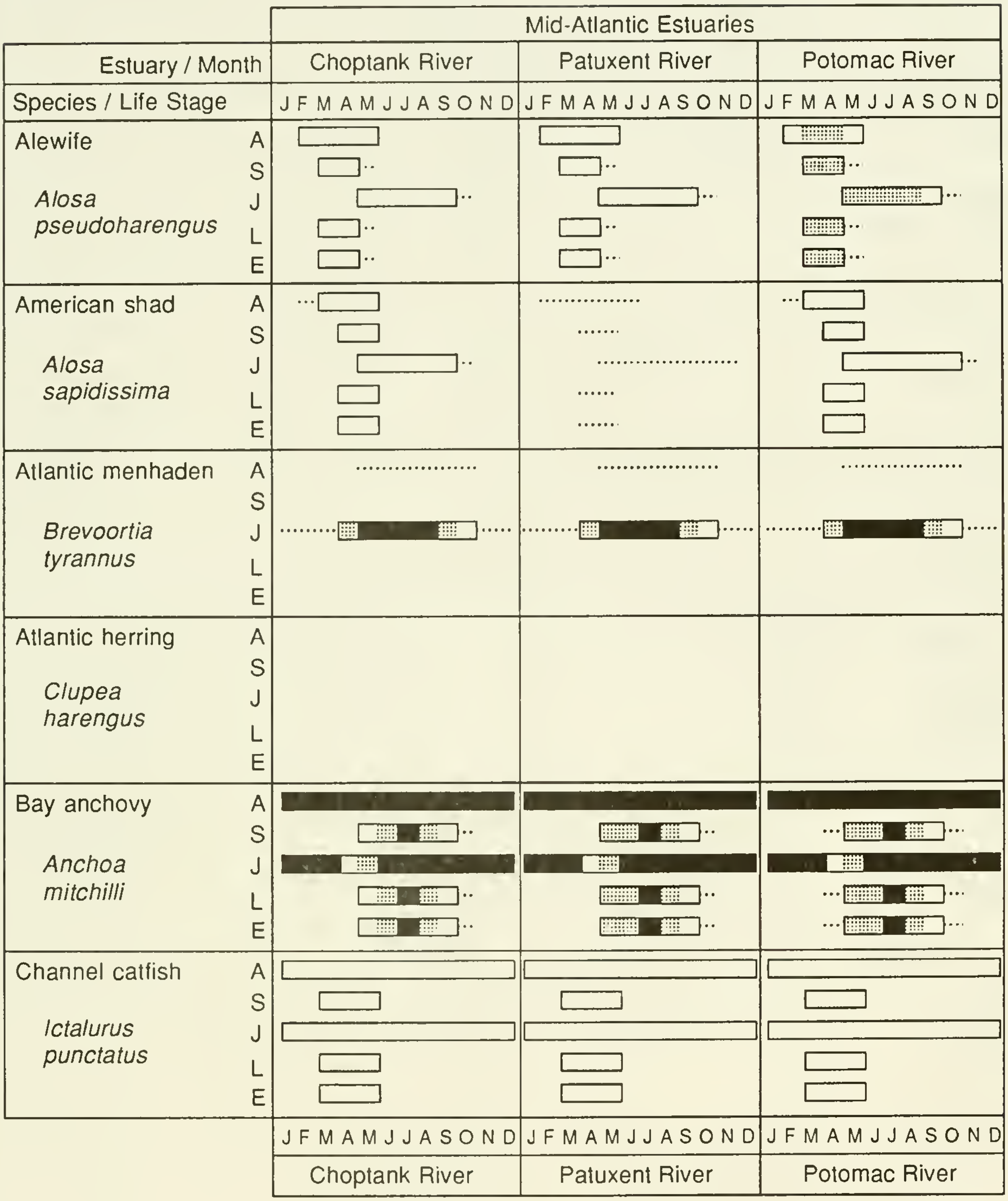
Relative Abundance

■	Highly Abundant
▨	Abundant
□	Common
....	Rare
Blank	Not Present

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs

Table 5, continued. Temporal distribution



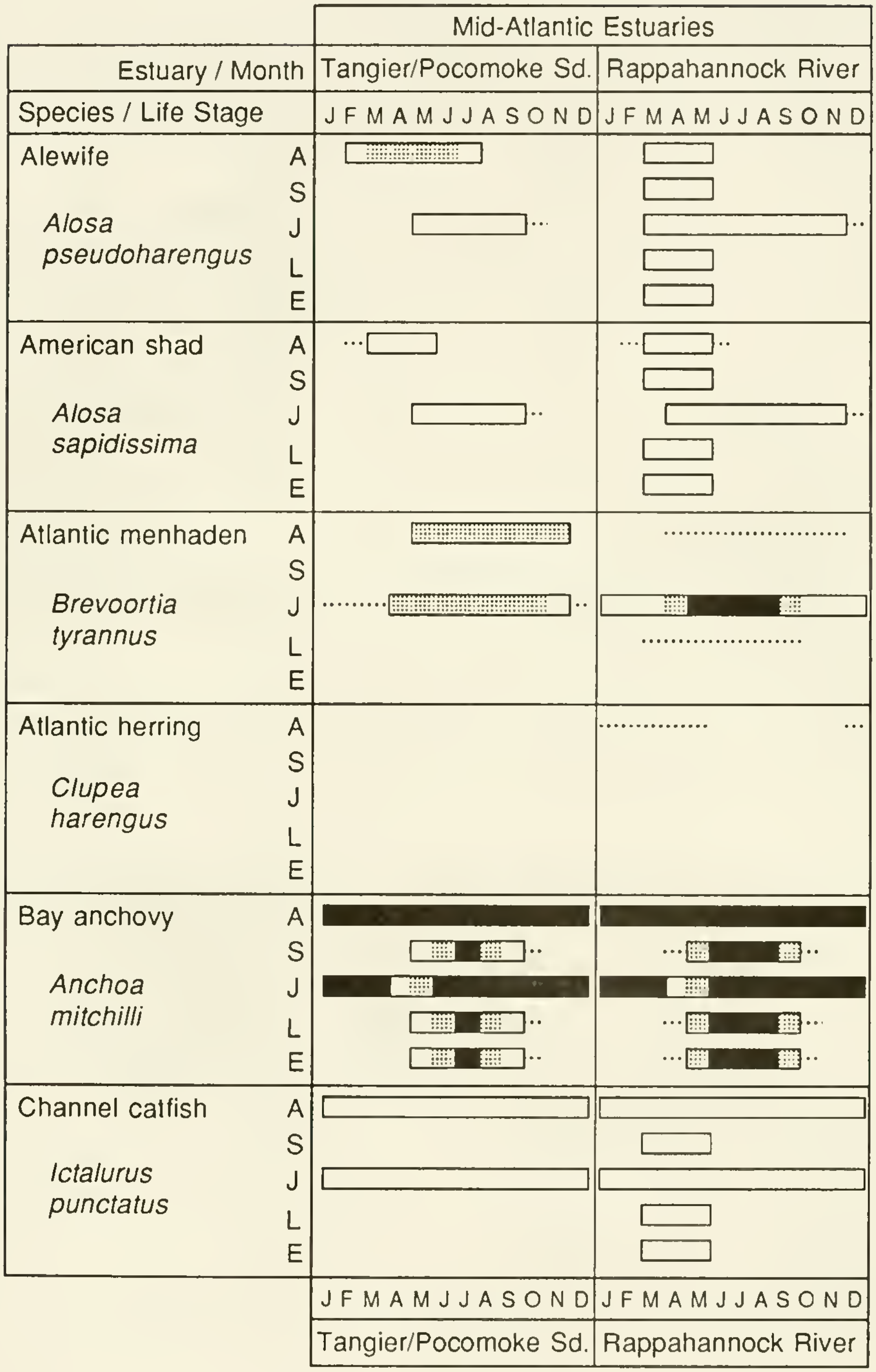
Relative Abundance

■	Highly Abundant
▨	Abundant
▭	Common
········	Rare
Blank	Not Present

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs

Table 5, continued. Temporal distribution

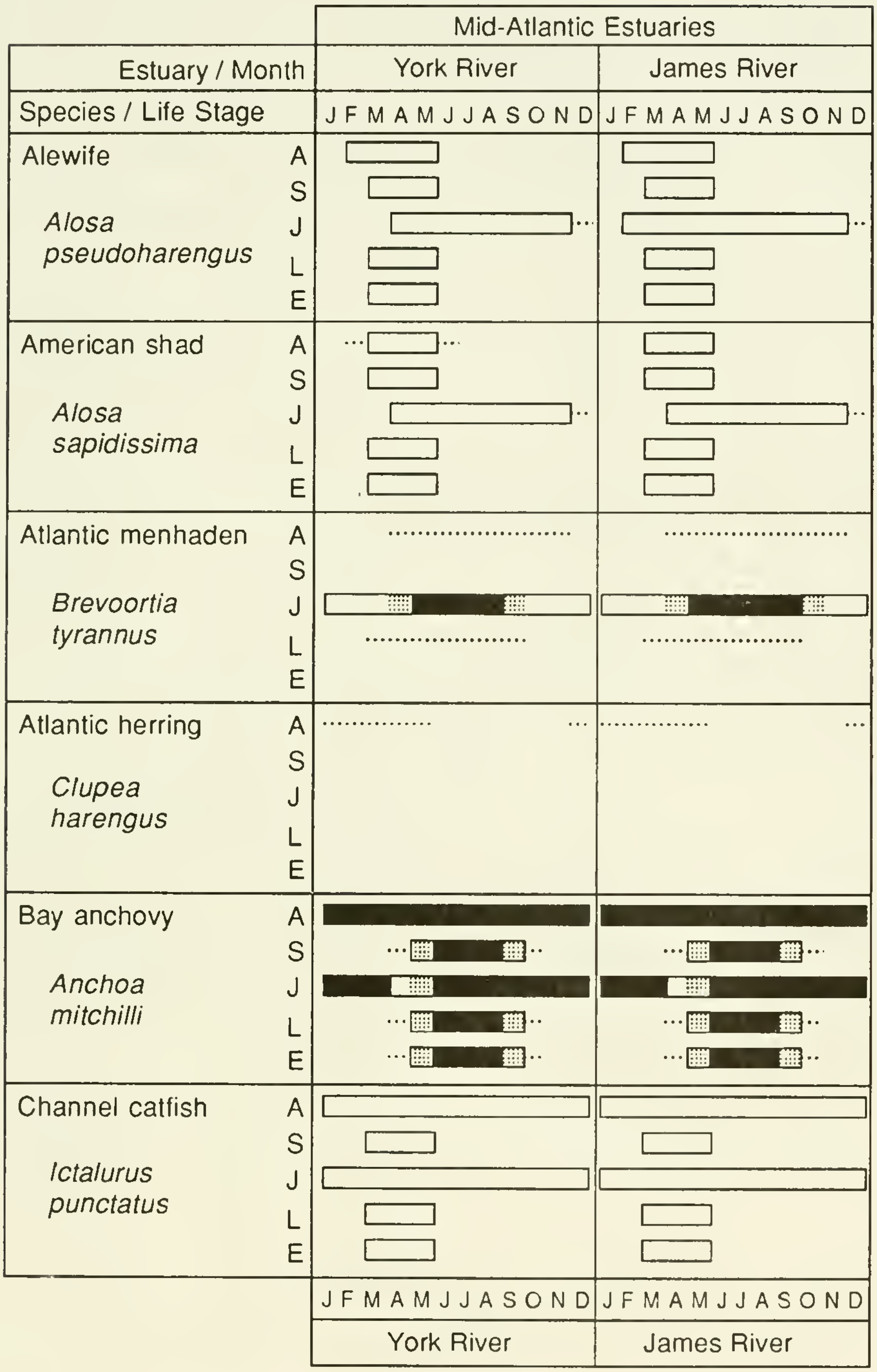


Relative Abundance	
■	Highly Abundant
▨	Abundant
☐	Common
········	Rare
Blank	Not Present

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs

Table 5, continued. Temporal distribution

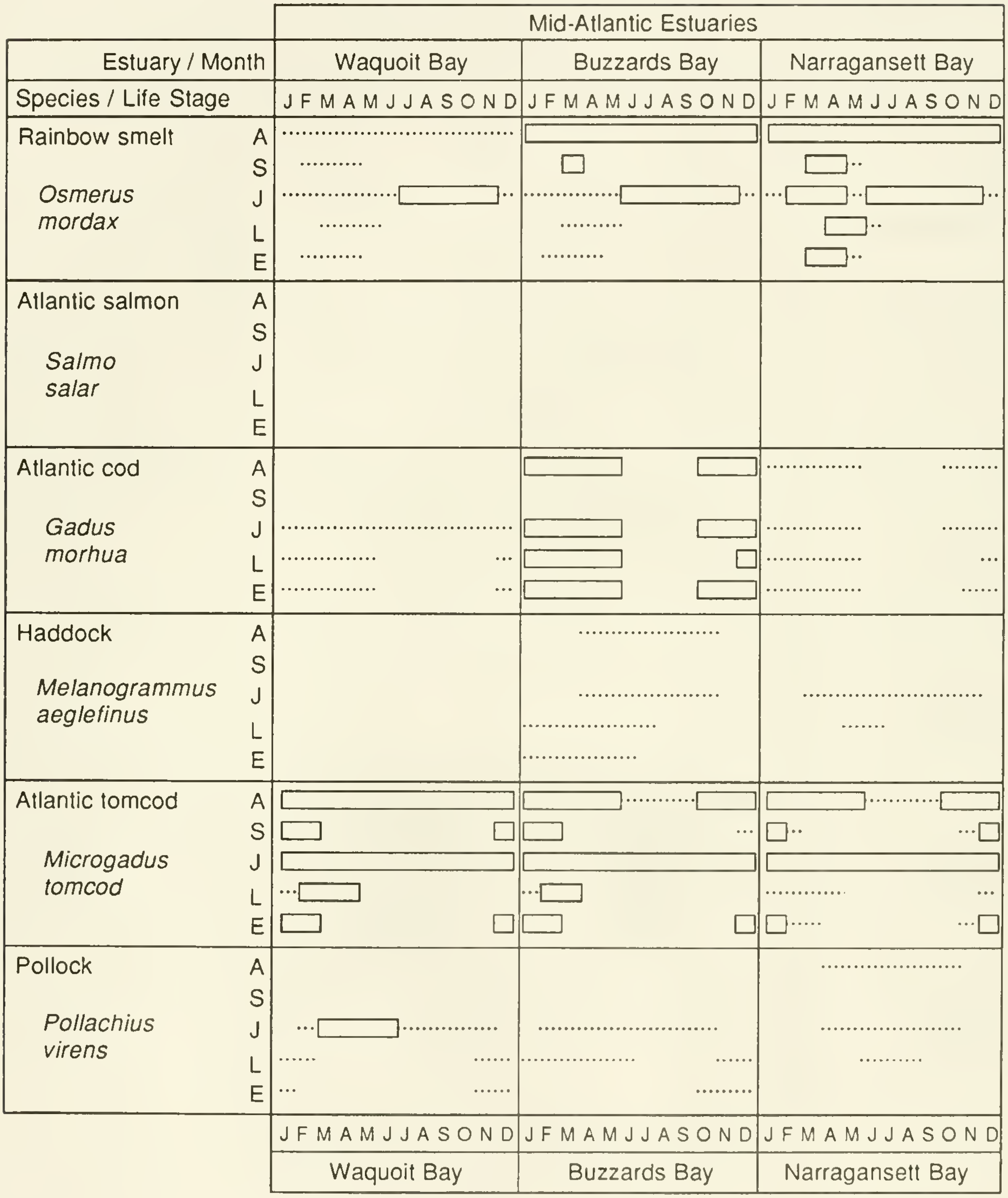


Relative Abundance	
■	Highly Abundant
▨	Abundant
☐	Common
·········	Rare
Blank	Not Present

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs

Table 5, continued. Temporal distribution



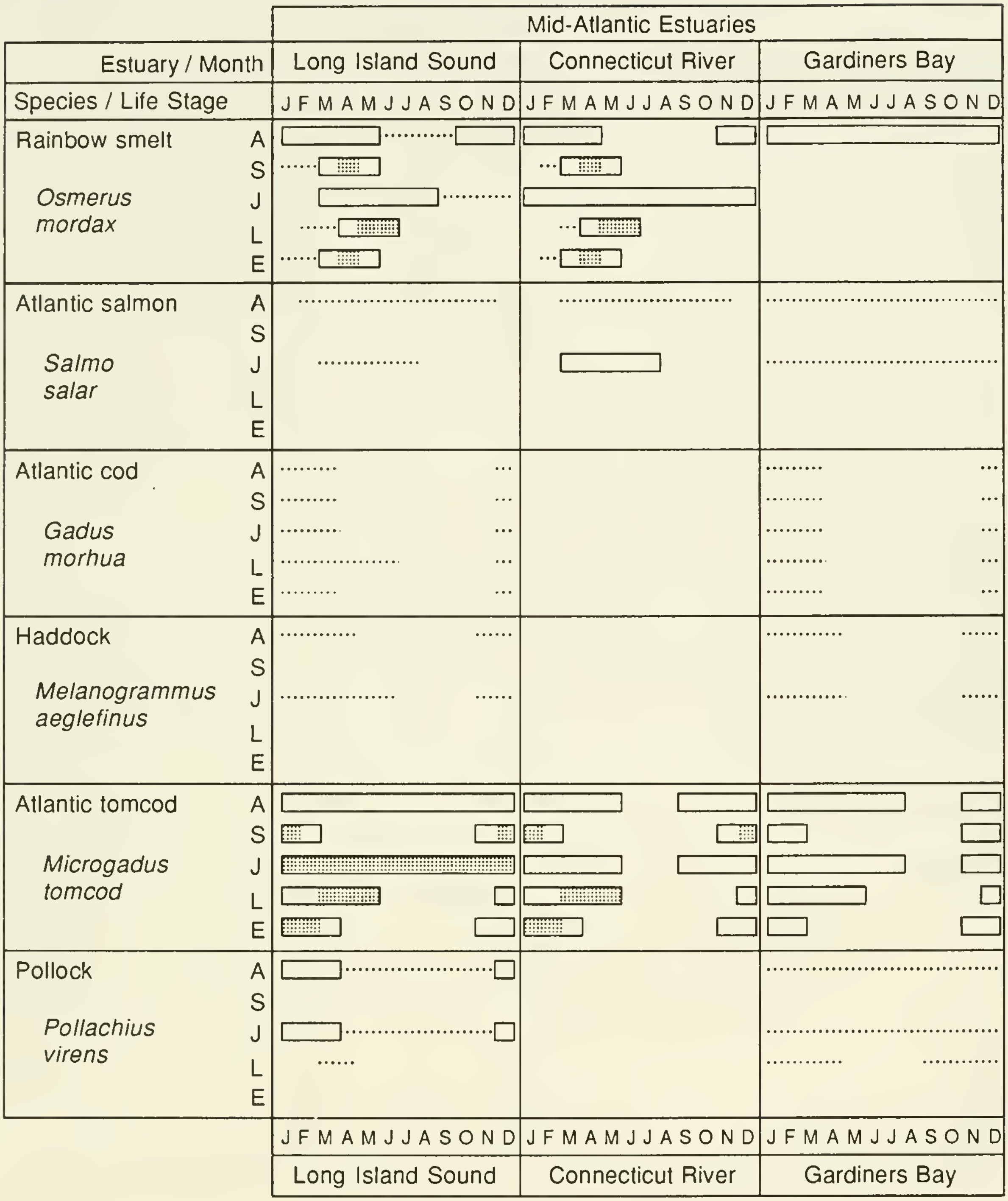
Relative Abundance

■	Highly Abundant
▨	Abundant
☐	Common
········	Rare
Blank	Not Present

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs

Table 5, continued. Temporal distribution



Relative Abundance

■ Highly Abundant

▨ Abundant

▭ Common

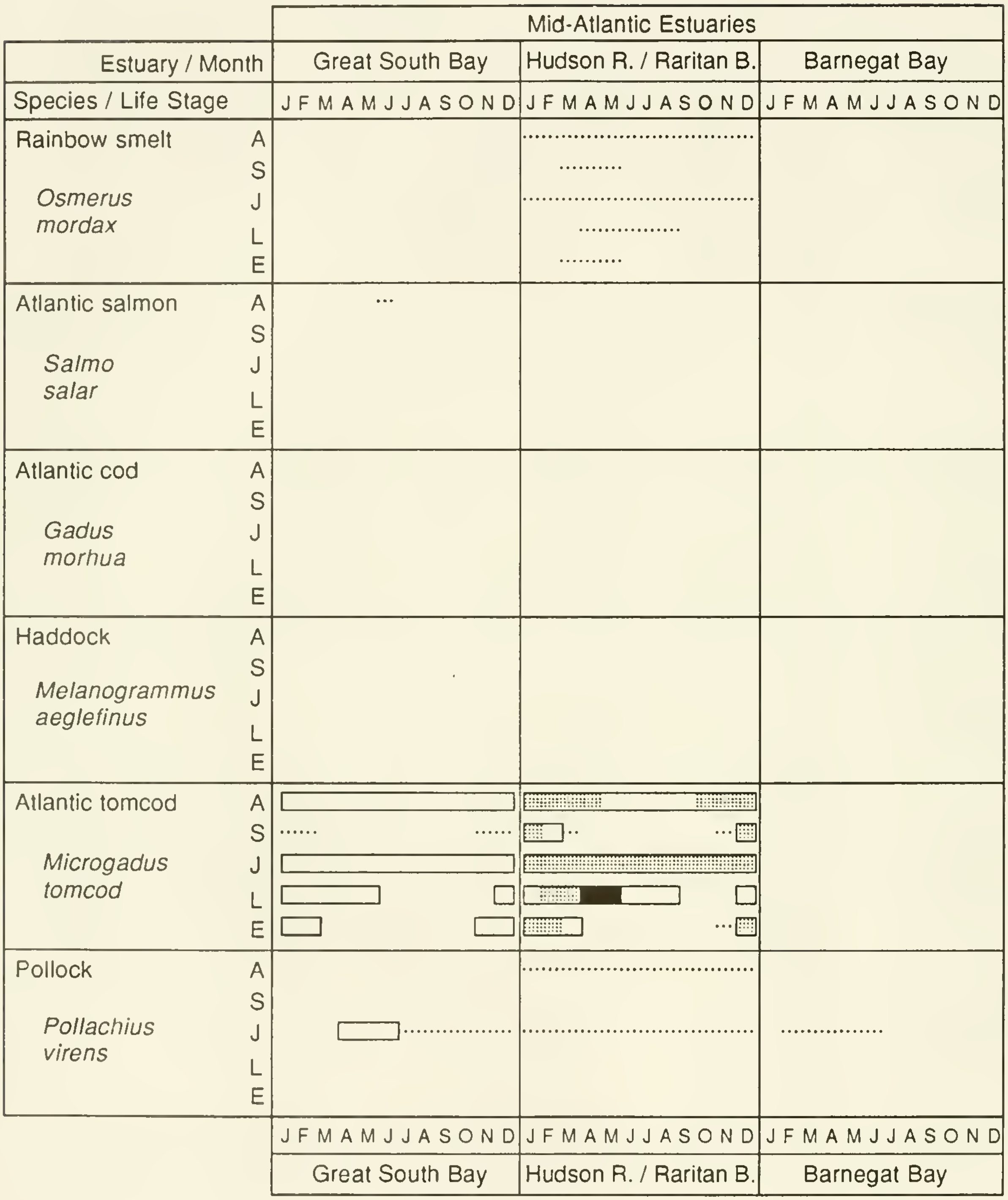
……… Rare

Blank Not Present

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs

Table 5, continued. Temporal distribution



Relative Abundance

■	Highly Abundant
▨	Abundant
☐	Common
········	Rare
Blank	Not Present

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs

Table 5, continued. Temporal distribution

		Mid-Atlantic Estuaries																																	
Estuary / Month		New Jersey Inland Bays												Delaware Bay												Delaware Inland Bays											
Species / Life Stage		J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
Rainbow smelt	A																																				
	S																																				
Osmerus mordax	J																																				
	L																																				
	E																																				
Atlantic salmon	A																																				
	S																																				
Salmo salar	J																																				
	L																																				
	E																																				
Atlantic cod	A																																				
	S																																				
Gadus morhua	J																																				
	L																																				
	E																																				
Haddock	A																																				
	S																																				
Melanogrammus aeglefinus	J																																				
	L																																				
	E																																				
Atlantic tomcod	A																																				
	S																																				
Microgadus tomcod	J																																				
	L																																				
	E																																				
Pollock	A																																				
	S																																				
Pollachius virens	J		⋯	⋯	⋯	⋯	⋯								⋯	⋯	⋯	⋯	⋯	⋯	⋯	⋯															
	L																																				
	E																																				
		J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
		New Jersey Inland Bays												Delaware Bay												Delaware Inland Bays											

Relative Abundance

■	Highly Abundant
▨	Abundant
☐	Common
⋯	Rare
Blank	Not Present

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs

Table 5, continued. Temporal distribution

		Mid-Atlantic Estuaries		
Estuary / Month		Chincoteague Bay	Chesapeake B. mainstem	Chester River
Species / Life Stage		J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D
Rainbow smelt *Osmerus mordax*	A			
	S			
	J			
	L			
	E			
Atlantic salmon *Salmo salar*	A			
	S			
	J			
	L			
	E			
Atlantic cod *Gadus morhua*	A			
	S			
	J			
	L			
	E			
Haddock *Melanogrammus aeglefinus*	A			
	S			
	J			
	L			
	E			
Atlantic tomcod *Microgadus tomcod*	A			
	S			
	J			
	L			
	E			
Pollock *Pollachius virens*	A			
	S			
	J			
	L			
	E			
		J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D
		Chincoteague Bay	Chesapeake B. mainstem	Chester River

Relative Abundance

■	Highly Abundant
▨	Abundant
▭	Common
········	Rare
Blank	Not Present

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs

Table 5, continued. Temporal distribution

		Mid-Atlantic Estuaries	
Estuary / Month	Choptank River	Patuxent River	Potomac River
Species / Life Stage	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D
Rainbow smelt *Osmerus mordax* A			
S			
J			
L			
E			
Atlantic salmon *Salmo salar* A			
S			
J			
L			
E			
Atlantic cod *Gadus morhua* A			
S			
J			
L			
E			
Haddock *Melanogrammus aeglefinus* A			
S			
J			
L			
E			
Atlantic tomcod *Microgadus tomcod* A			
S			
J			
L			
E			
Pollock *Pollachius virens* A			
S			
J			
L			
E			
	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D
	Choptank River	Patuxent River	Potomac River

Relative Abundance

■	Highly Abundant
▨	Abundant
▭	Common
⋯⋯	Rare
Blank	Not Present

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs

Table 5, continued. Temporal distribution

Estuary / Month		Mid-Atlantic Estuaries																							
		Tangier/Pocomoke Sd.												Rappahannock River											
Species / Life Stage		J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
Rainbow smelt *Osmerus mordax*	A																								
	S																								
	J																								
	L																								
	E																								
Atlantic salmon *Salmo salar*	A																								
	S																								
	J																								
	L																								
	E																								
Atlantic cod *Gadus morhua*	A																								
	S																								
	J																								
	L																								
	E																								
Haddock *Melanogrammus aeglefinus*	A																								
	S																								
	J																								
	L																								
	E																								
Atlantic tomcod *Microgadus tomcod*	A																								
	S																								
	J																								
	L																								
	E																								
Pollock *Pollachius virens*	A																								
	S																								
	J																								
	L																								
	E																								
		J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
		Tangier/Pocomoke Sd.												Rappahannock River											

Relative Abundance

▬	Highly Abundant
▨	Abundant
▭	Common
········	Rare
Blank	Not Present

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs

Table 5, continued. Temporal distribution

		Mid-Atlantic Estuaries	
Estuary / Month		York River	James River
Species / Life Stage		J F M A M J J A S O N D	J F M A M J J A S O N D
Rainbow smelt	A		
	S		
Osmerus mordax	J		
	L		
	E		
Atlantic salmon	A		
	S		
Salmo salar	J		
	L		
	E		
Atlantic cod	A		
	S		
Gadus morhua	J		
	L		
	E		
Haddock	A		
	S		
Melanogrammus aeglefinus	J		
	L		
	E		
Atlantic tomcod	A		
	S		
Microgadus tomcod	J		
	L		
	E		
Pollock	A		
	S		
Pollachius virens	J		
	L		
	E		
		J F M A M J J A S O N D	J F M A M J J A S O N D
		York River	James River

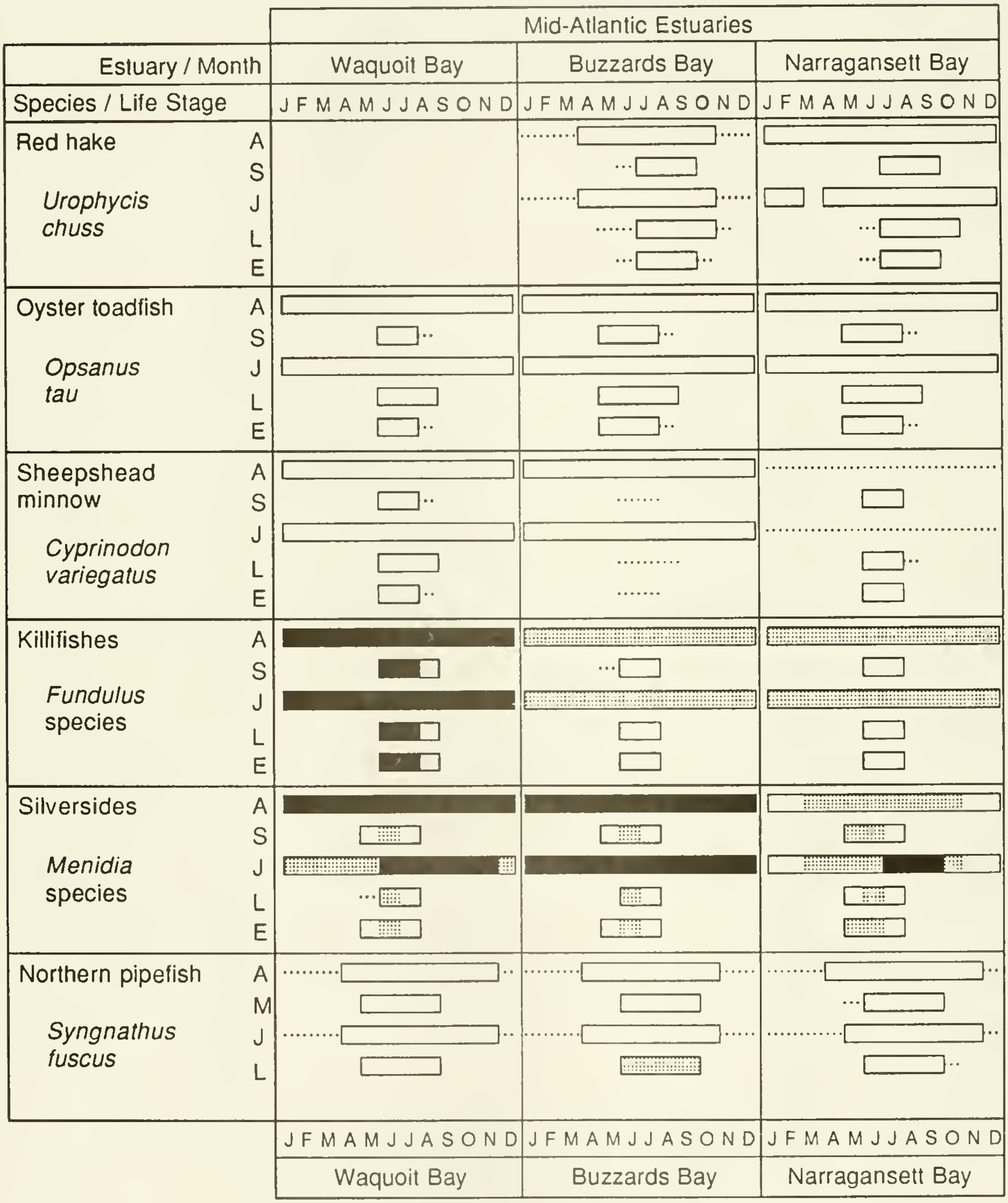
Relative Abundance

■	Highly Abundant
▨	Abundant
▭	Common
·········	Rare
Blank	Not Present

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs

Table 5, continued. Temporal distribution



Relative Abundance

■ Highly Abundant

▨ Abundant

☐ Common

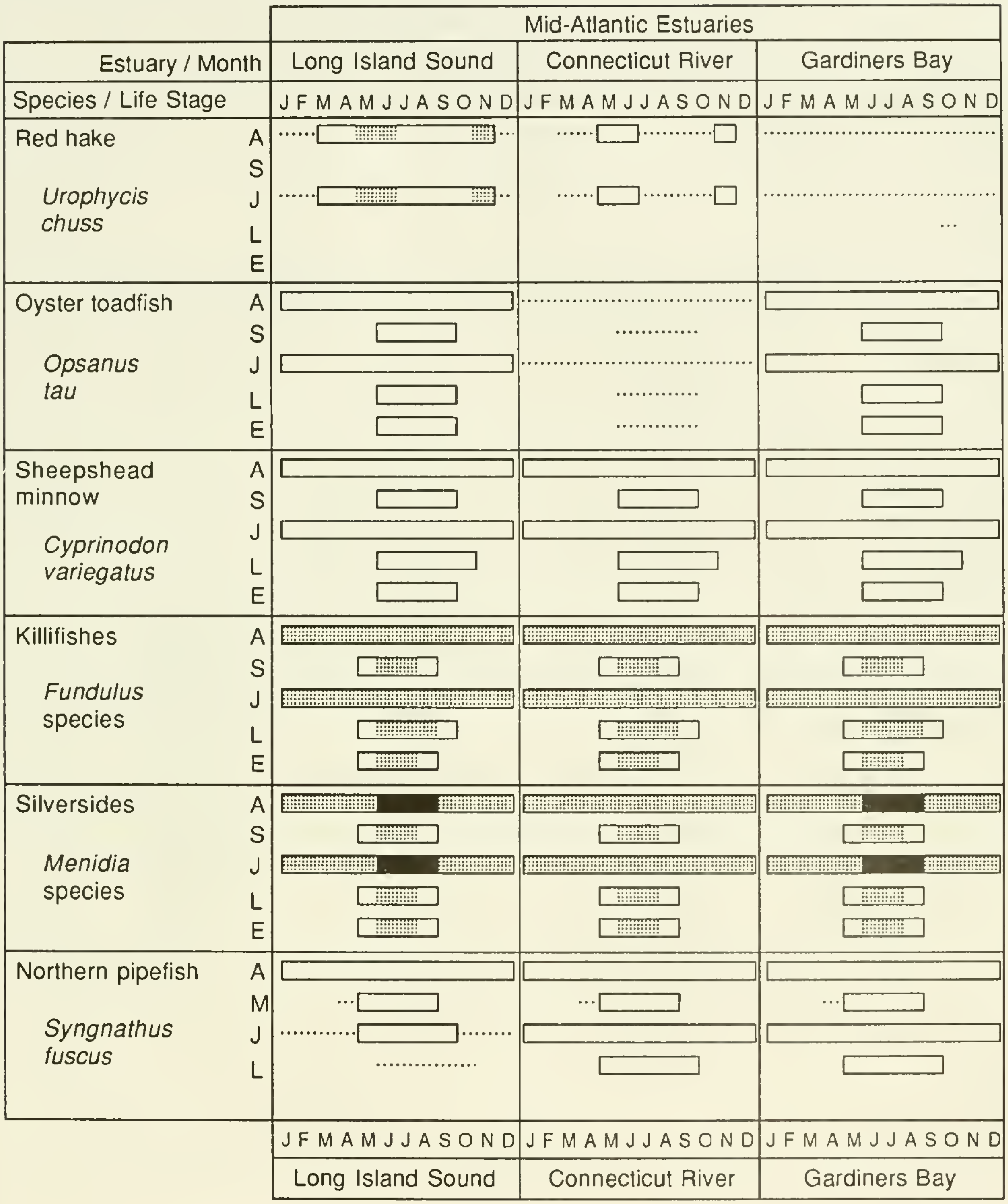
.... Rare

Blank Not Present

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs
M - Mating

Table 5, continued. Temporal distribution



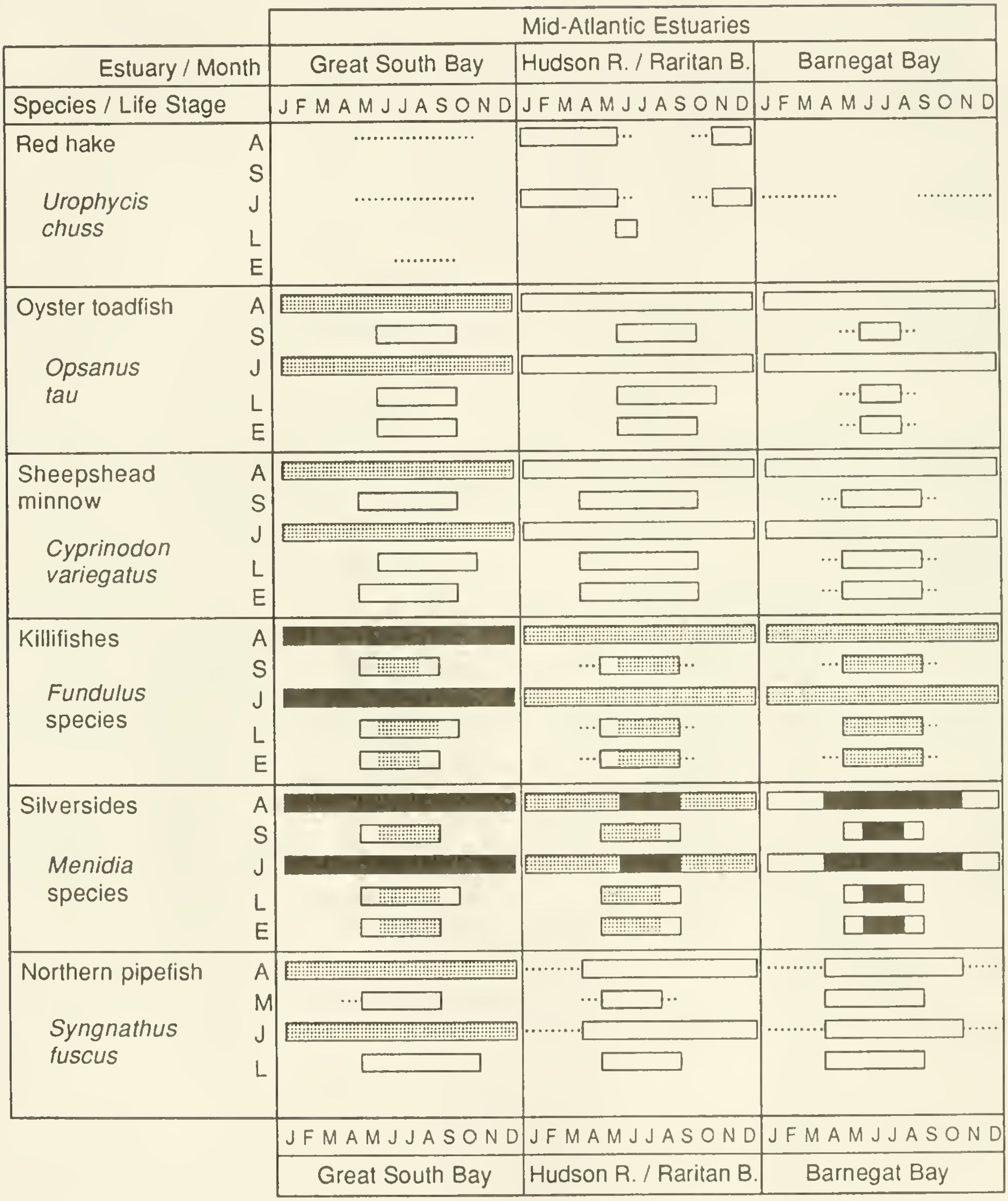
Relative Abundance

■	Highly Abundant
▨	Abundant
☐	Common
········	Rare
Blank	Not Present

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs
M - Mating

Table 5, continued. Temporal distribution



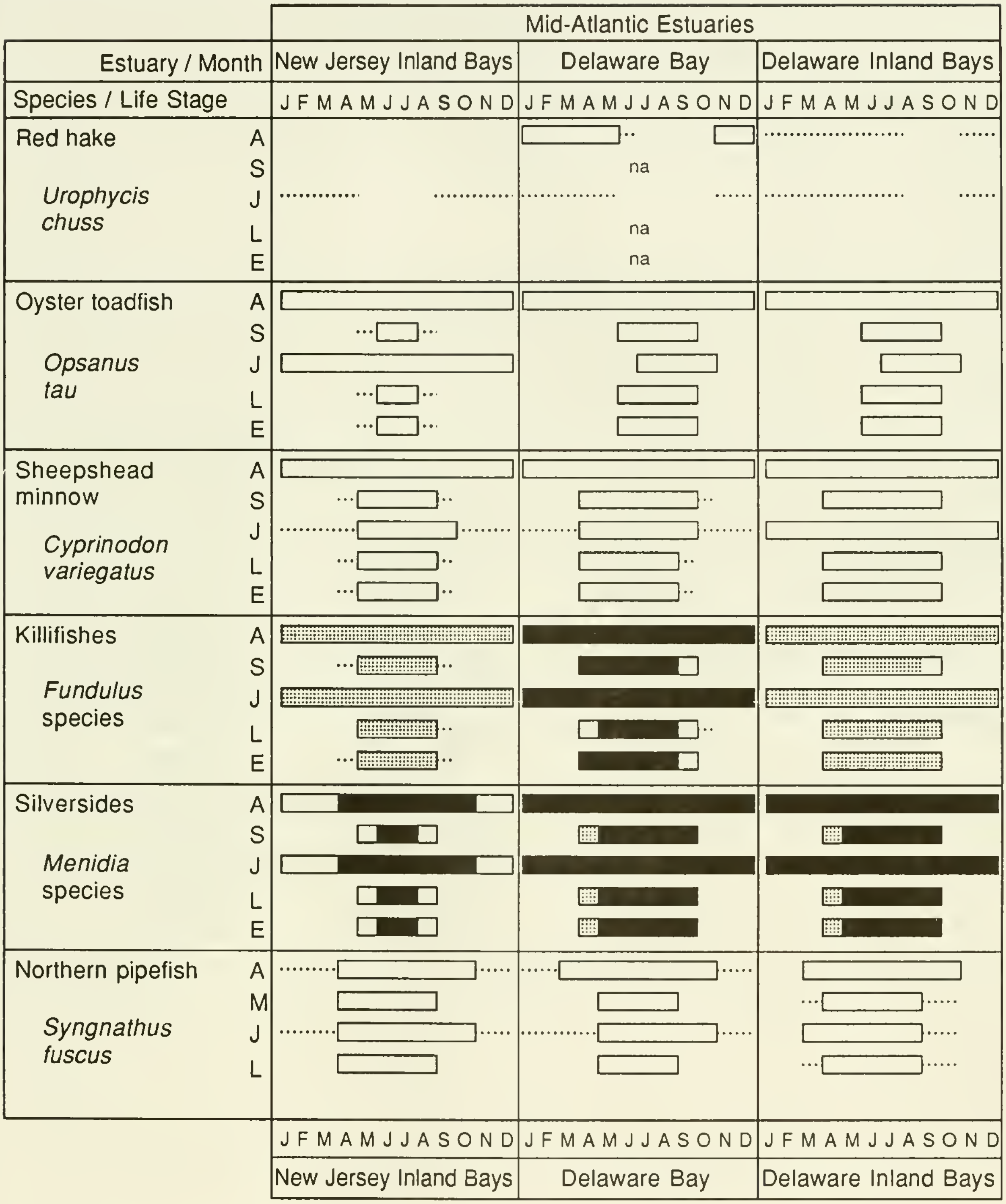
Relative Abundance

■	Highly Abundant
▨	Abundant
☐	Common
········	Rare
Blank	Not Present

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs
M - Mating

Table 5, continued. Temporal distribution

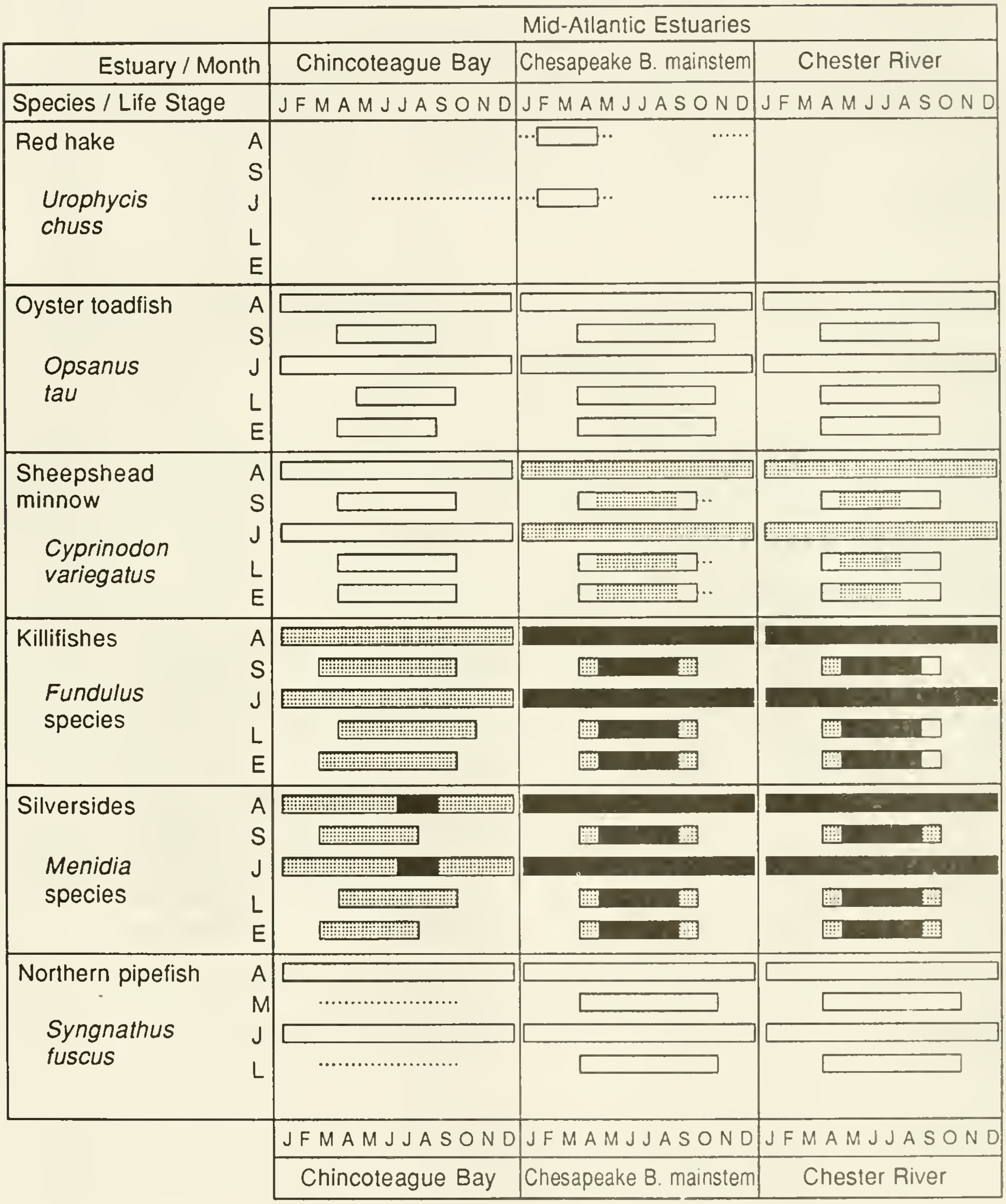

Mid-Atlantic Estuaries
Estuary / Month
New Jersey Inland Bays
Delaware Bay
Delaware Inland Bays
Species / Life Stage
J F M A M J J A S O N D
Red hake
Urophycis chuss
A
S
J
L
E
na
Oyster toadfish
Opsanus tau
A
S
J
L
E
Sheepshead minnow
Cyprinodon variegatus
A
S
J
L
E
Killifishes
Fundulus species
A
S
J
L
E
Silversides
Menidia species
A
S
J
L
E
Northern pipefish
Syngnathus fuscus
A
M
J
L
J F M A M J J A S O N D
New Jersey Inland Bays
Delaware Bay
Delaware Inland Bays

Relative Abundance	
■	Highly Abundant
▒	Abundant
□	Common
········	Rare
Blank	Not Present
na	No Data Available

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs
M - Mating

Table 5, continued. Temporal distribution



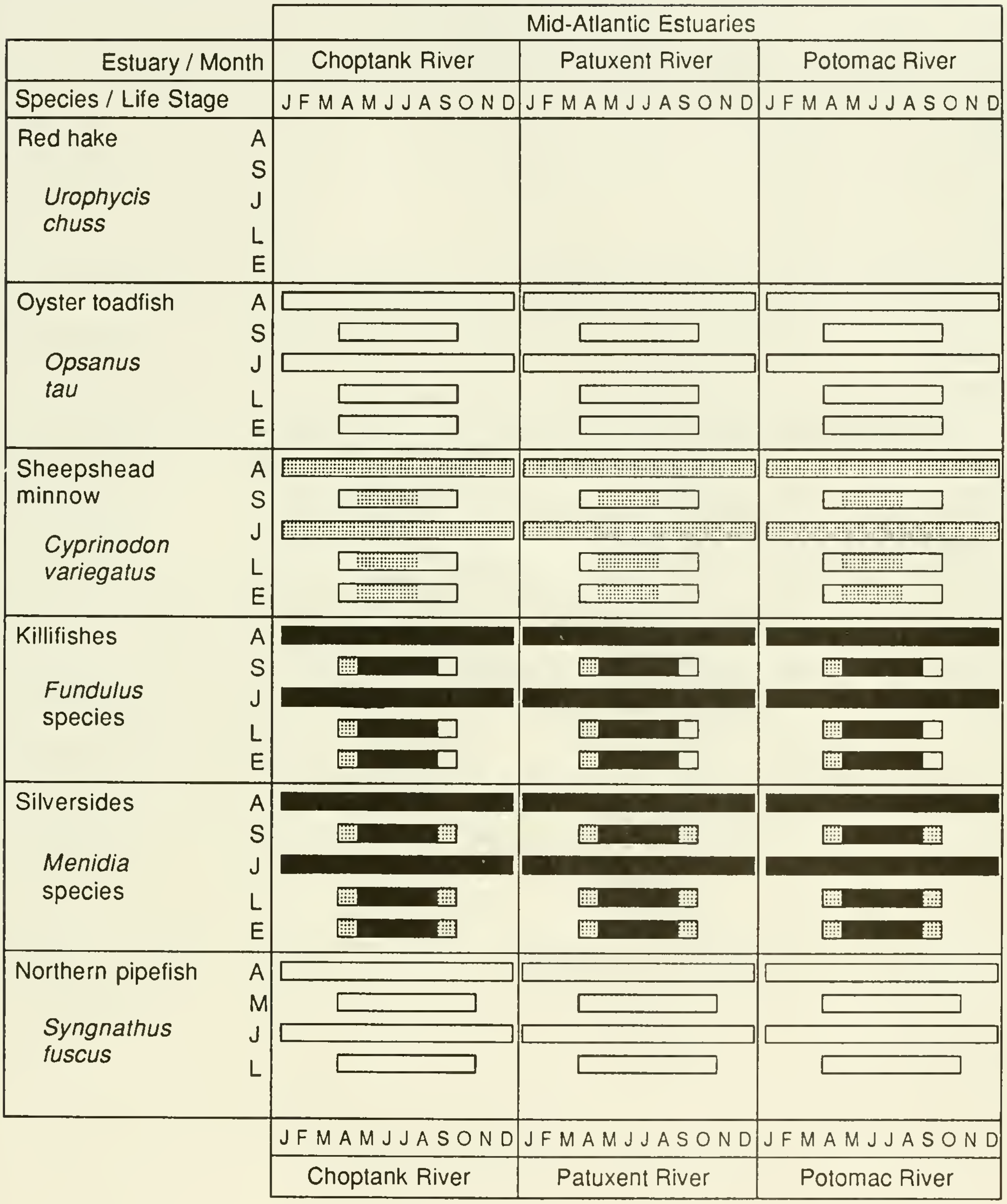
Relative Abundance

■	Highly Abundant
▨	Abundant
☐	Common
....	Rare
Blank	Not Present

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs
M - Mating

Table 5, continued. Temporal distribution



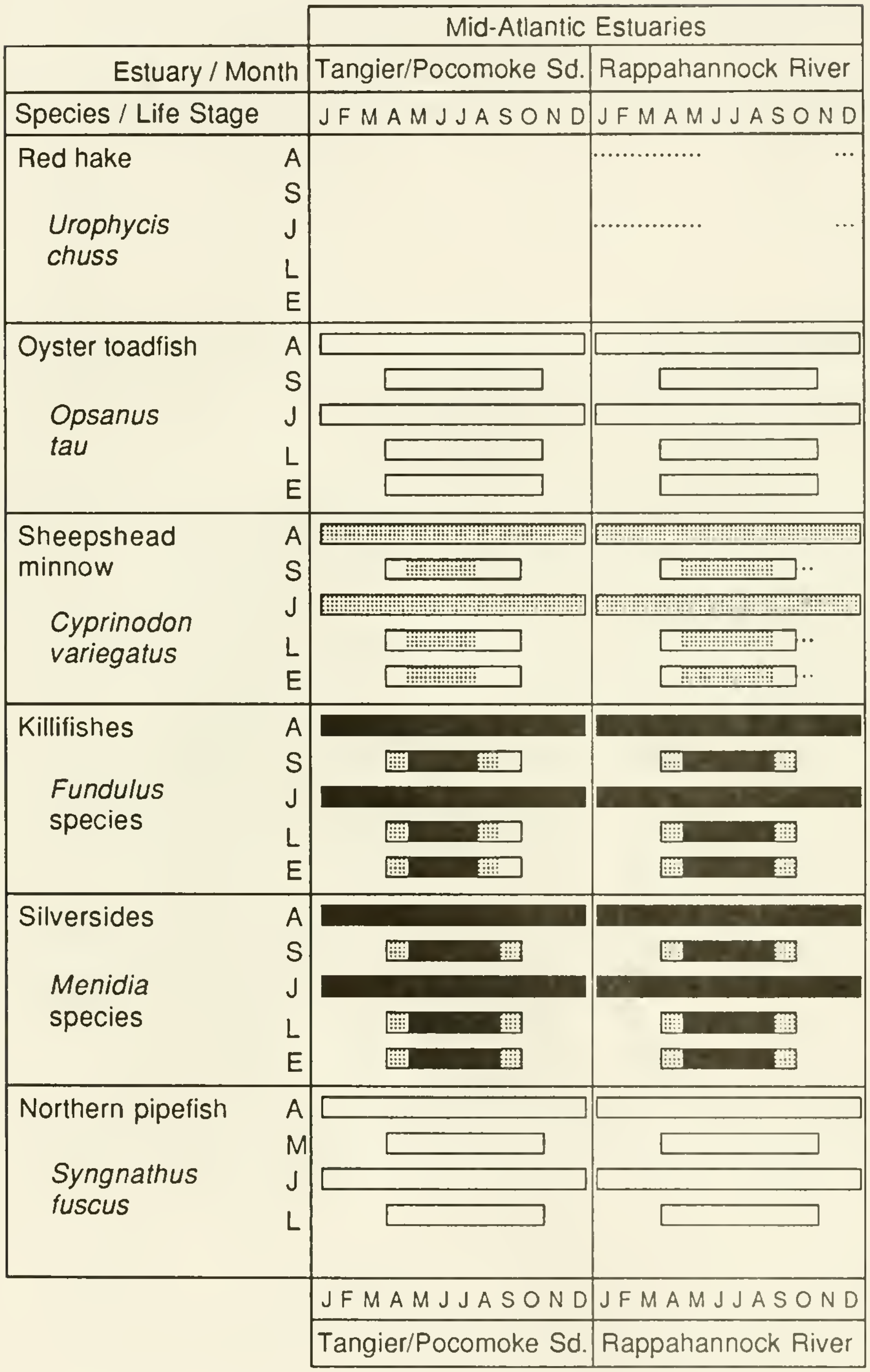
Relative Abundance

■	Highly Abundant
▨	Abundant
☐	Common
....	Rare
Blank	Not Present

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs
M - Mating

Table 5, continued. Temporal distribution

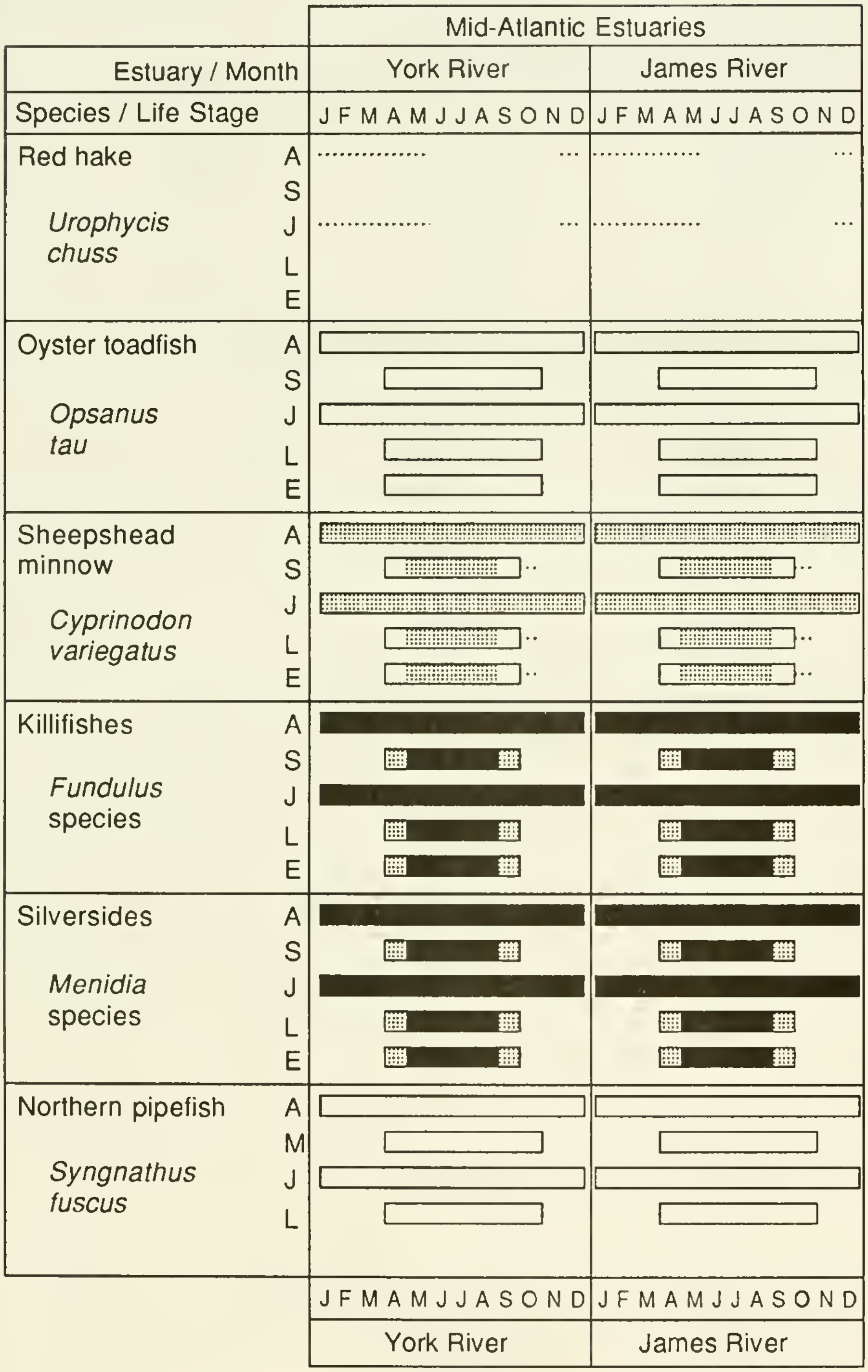


Relative Abundance	
■	Highly Abundant
▨	Abundant
☐	Common
········	Rare
Blank	Not Present

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs
M - Mating

Table 5, continued. Temporal distribution



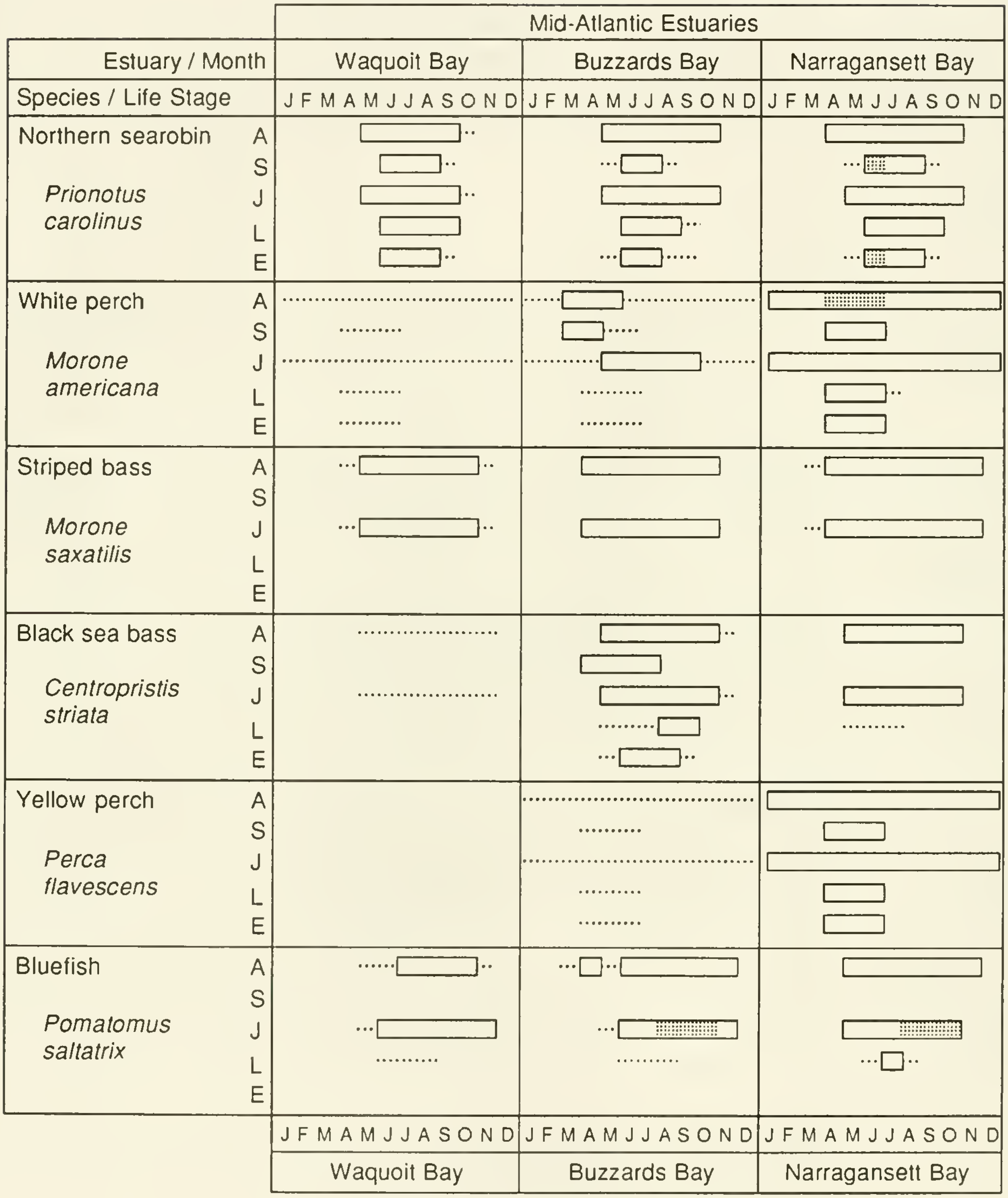
Relative Abundance

■	Highly Abundant
▨	Abundant
▭	Common
....	Rare
Blank	Not Present

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs
M - Mating

Table 5, continued. Temporal distribution

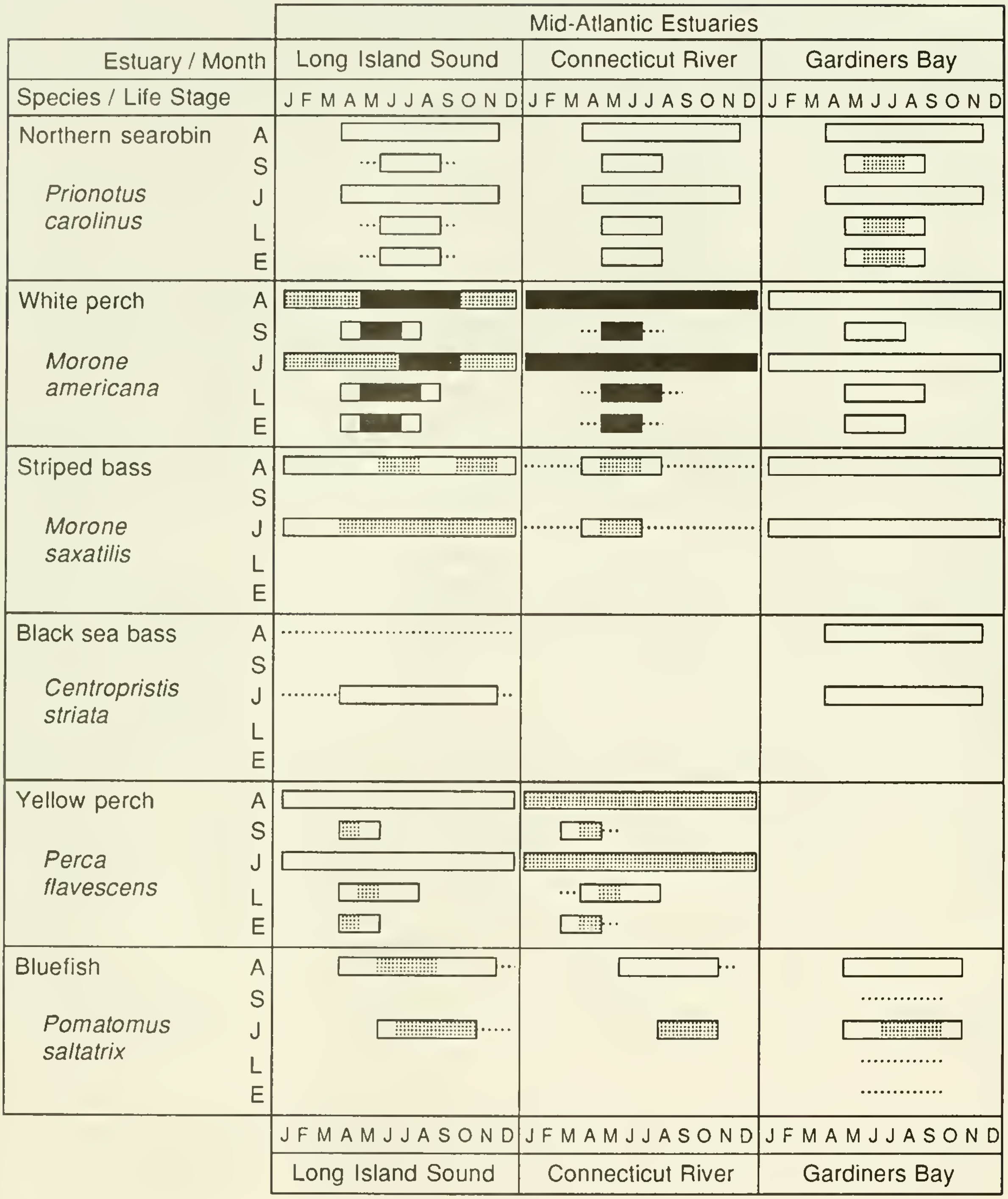


Relative Abundance	
■	Highly Abundant
▨	Abundant
▭	Common
········	Rare
Blank	Not Present

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs

Table 5, continued. Temporal distribution



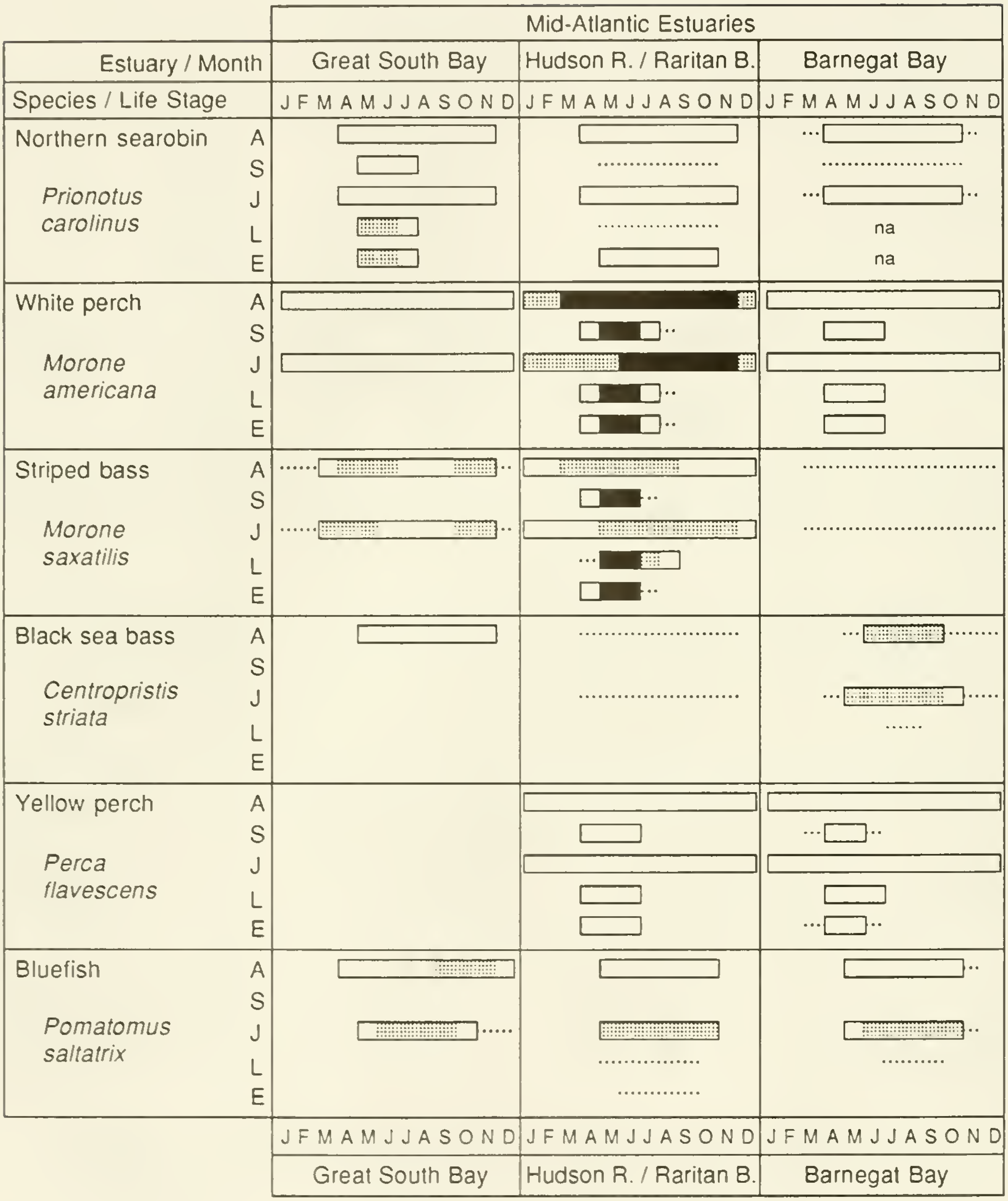
Relative Abundance

■	Highly Abundant
▨	Abundant
▭	Common
········	Rare
Blank	Not Present

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs

Table 5, continued. Temporal distribution



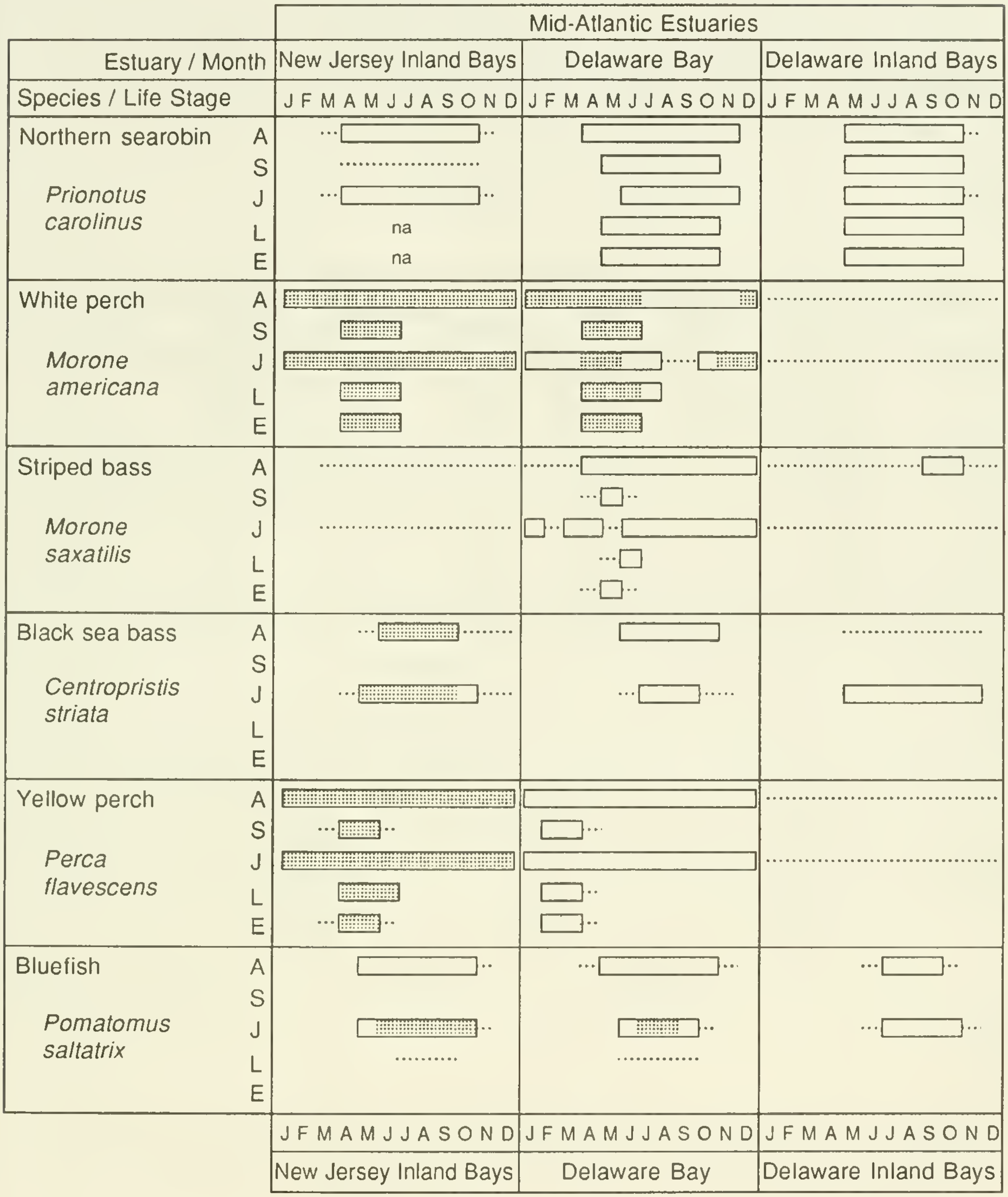
Relative Abundance

■	Highly Abundant
▨	Abundant
☐	Common
....	Rare
Blank	Not Present
na	No Data Available

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs

Table 5, continued. Temporal distribution



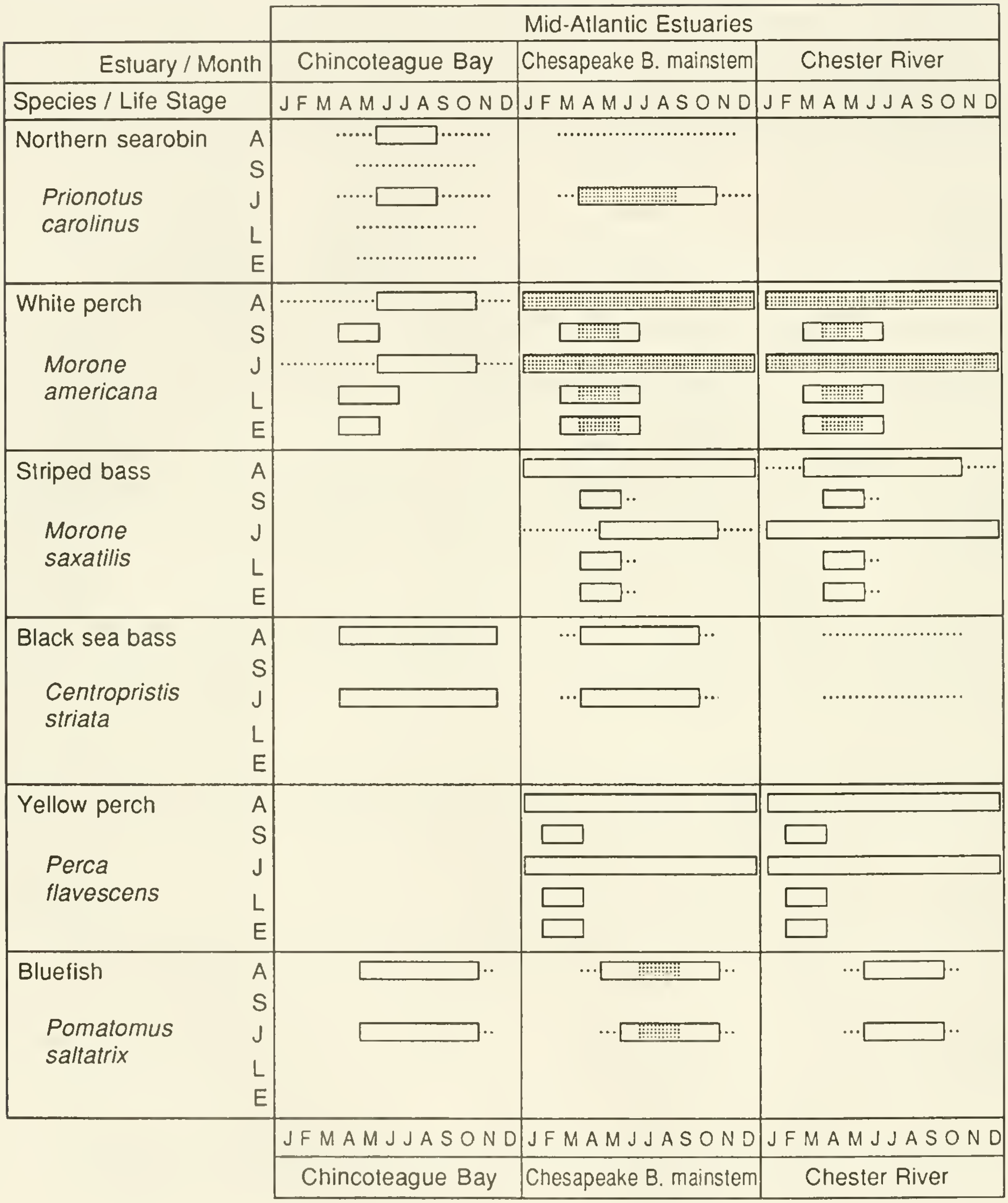
Relative Abundance

■	Highly Abundant
▨	Abundant
▭	Common
....	Rare
Blank	Not Present
na	No Data Available

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs

Table 5, continued. Temporal distribution



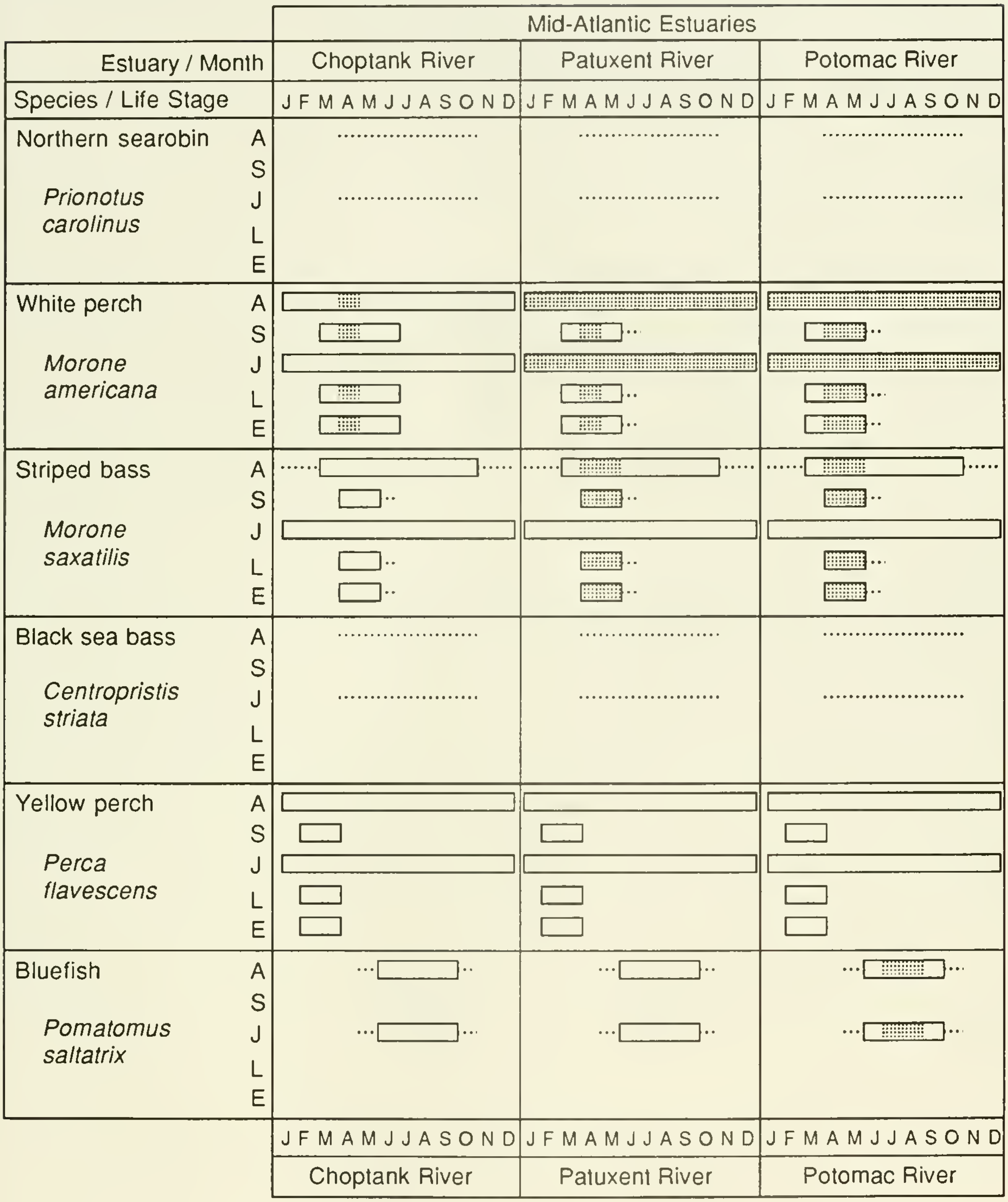
Relative Abundance

■	Highly Abundant
▨	Abundant
☐	Common
········	Rare
Blank	Not Present

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs

Table 5, continued. Temporal distribution



Relative Abundance

■	Highly Abundant
▨	Abundant
☐	Common
·········	Rare
Blank	Not Present

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs

Table 5, continued. Temporal distribution

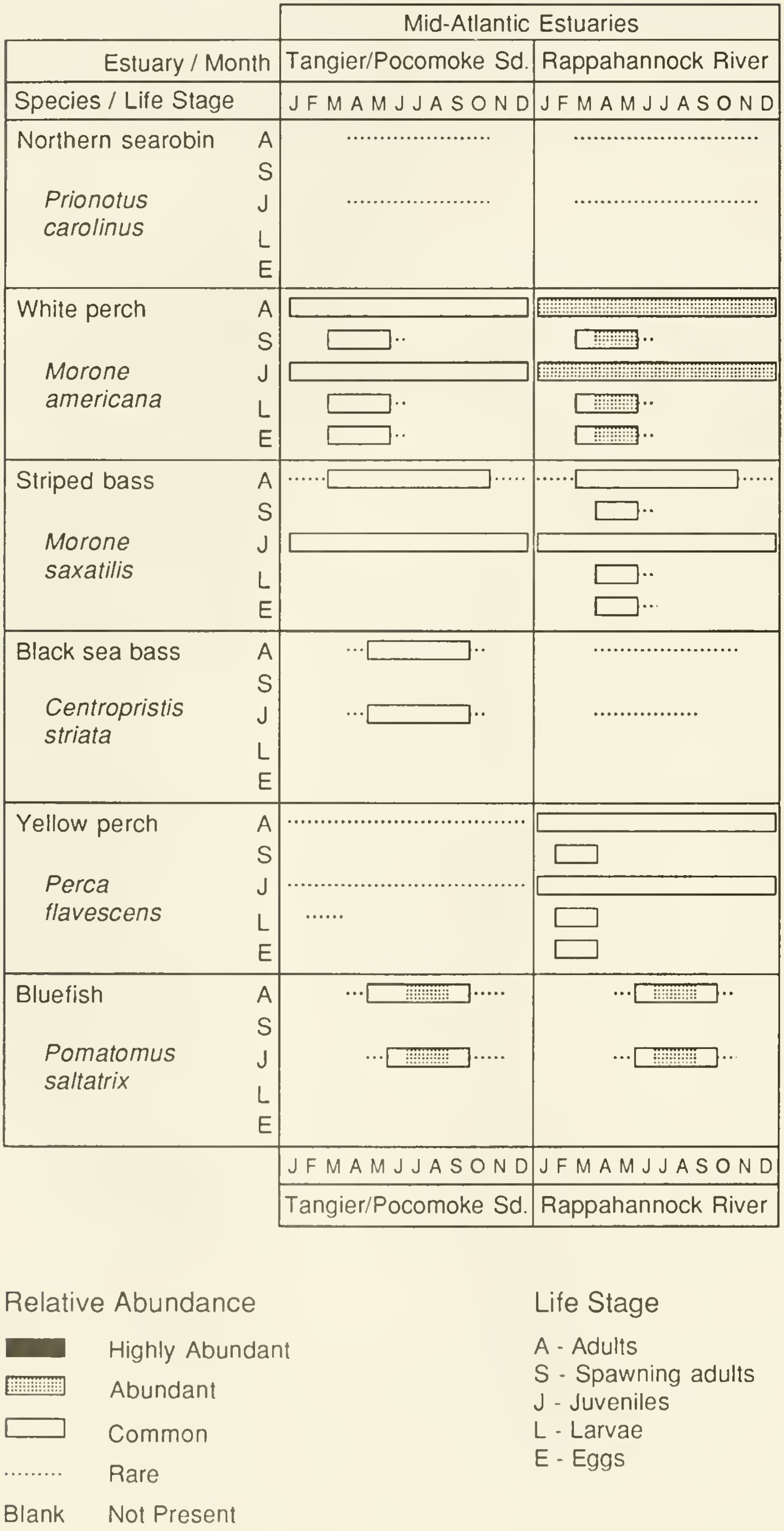
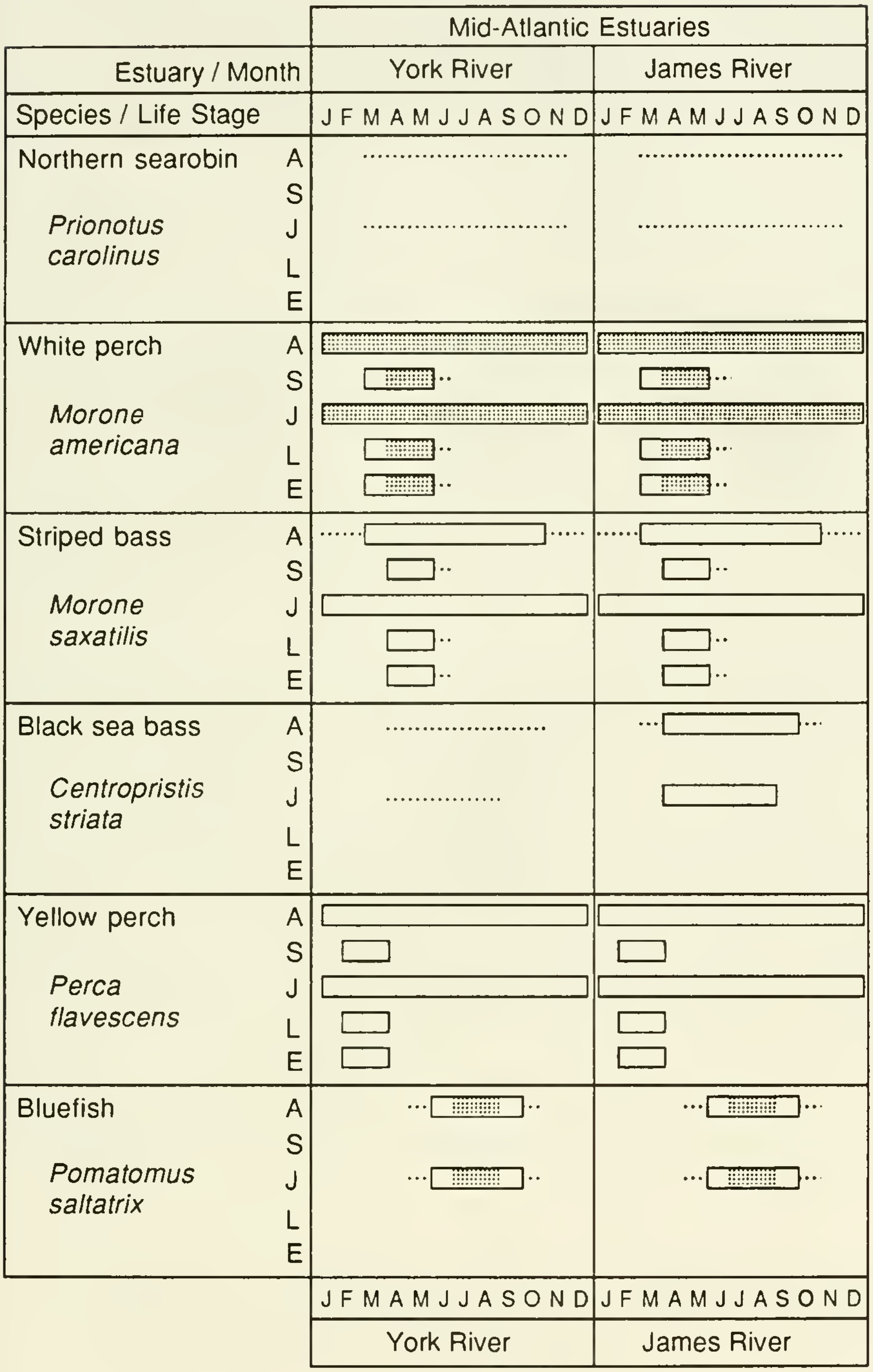


Table 5, continued. Temporal distribution



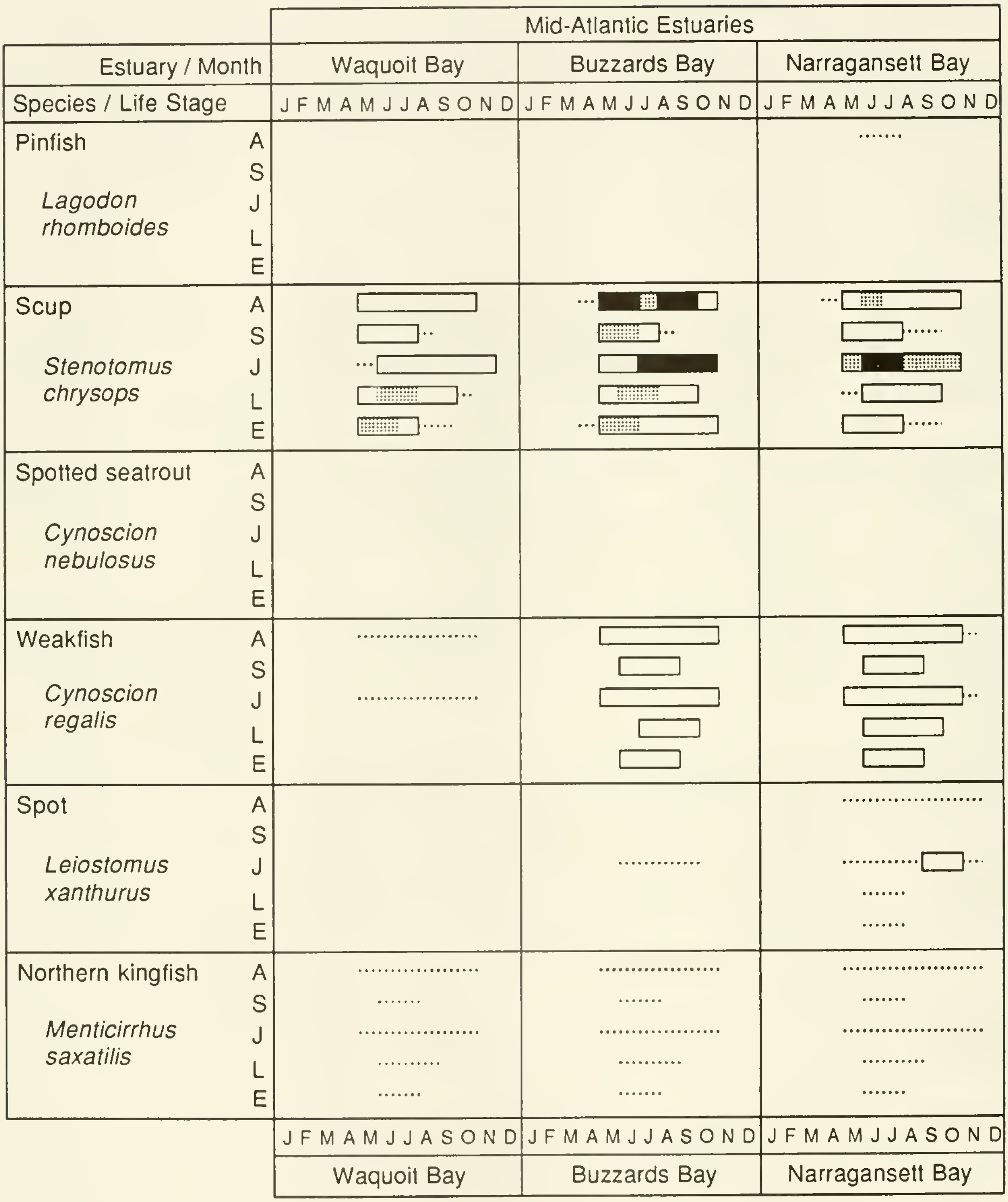
Relative Abundance

■	Highly Abundant
▨	Abundant
▭	Common
....	Rare
Blank	Not Present

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs

Table 5, continued. Temporal distribution



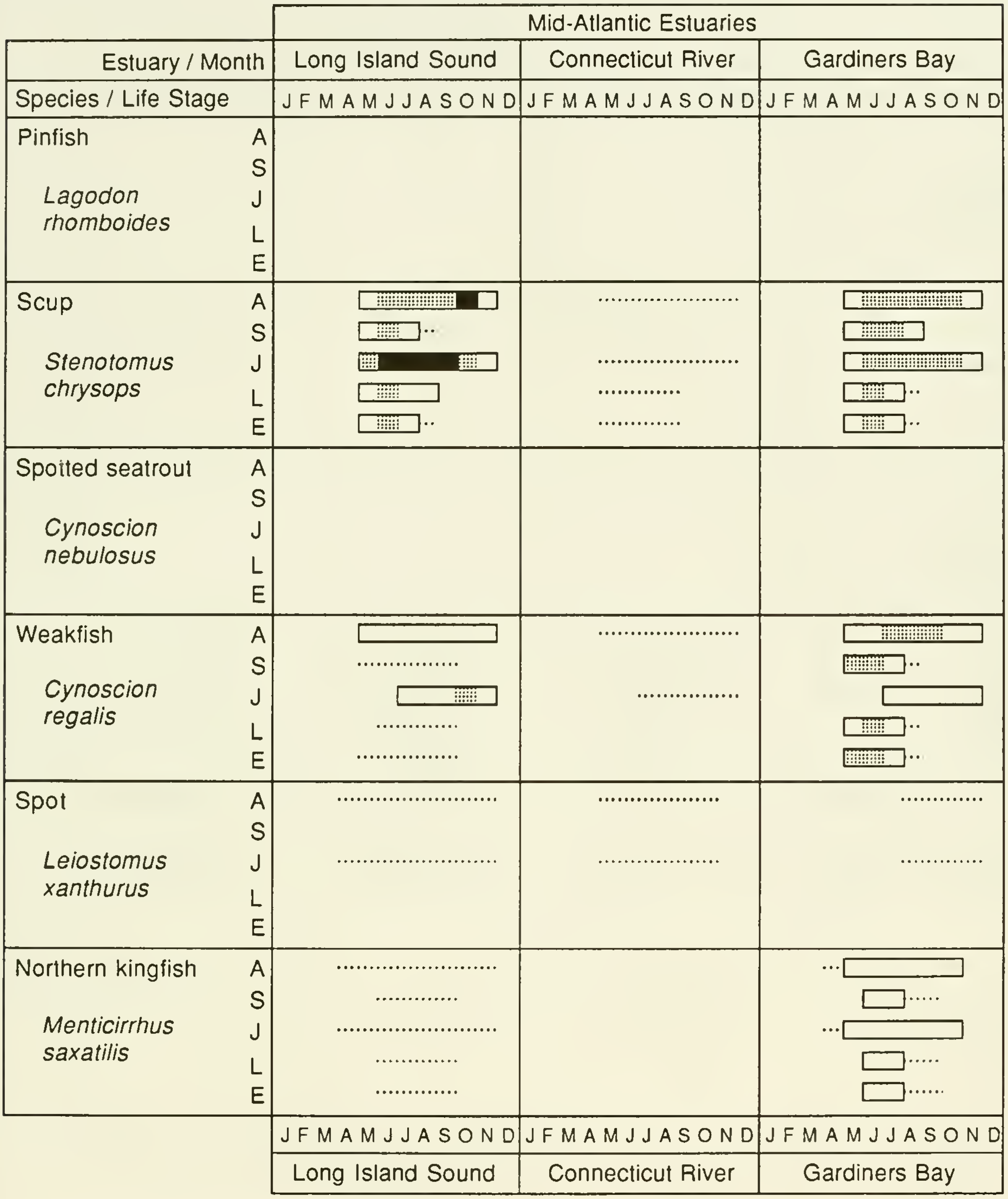
Relative Abundance

■	Highly Abundant
▨	Abundant
☐	Common
········	Rare
Blank	Not Present

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs

Table 5, continued. Temporal distribution

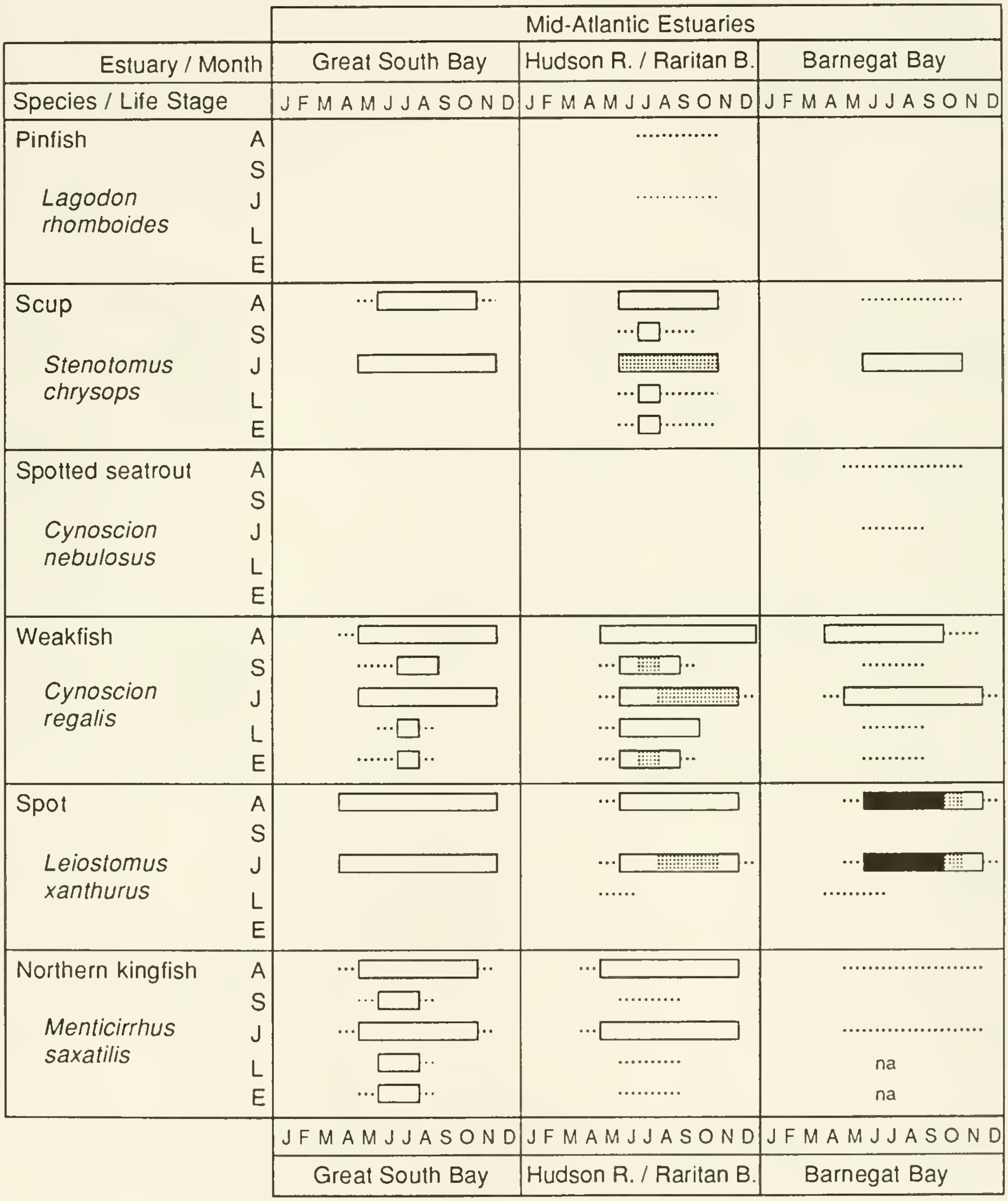


Relative Abundance	
■	Highly Abundant
▨	Abundant
□	Common
....	Rare
Blank	Not Present

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs

Table 5, continued. Temporal distribution



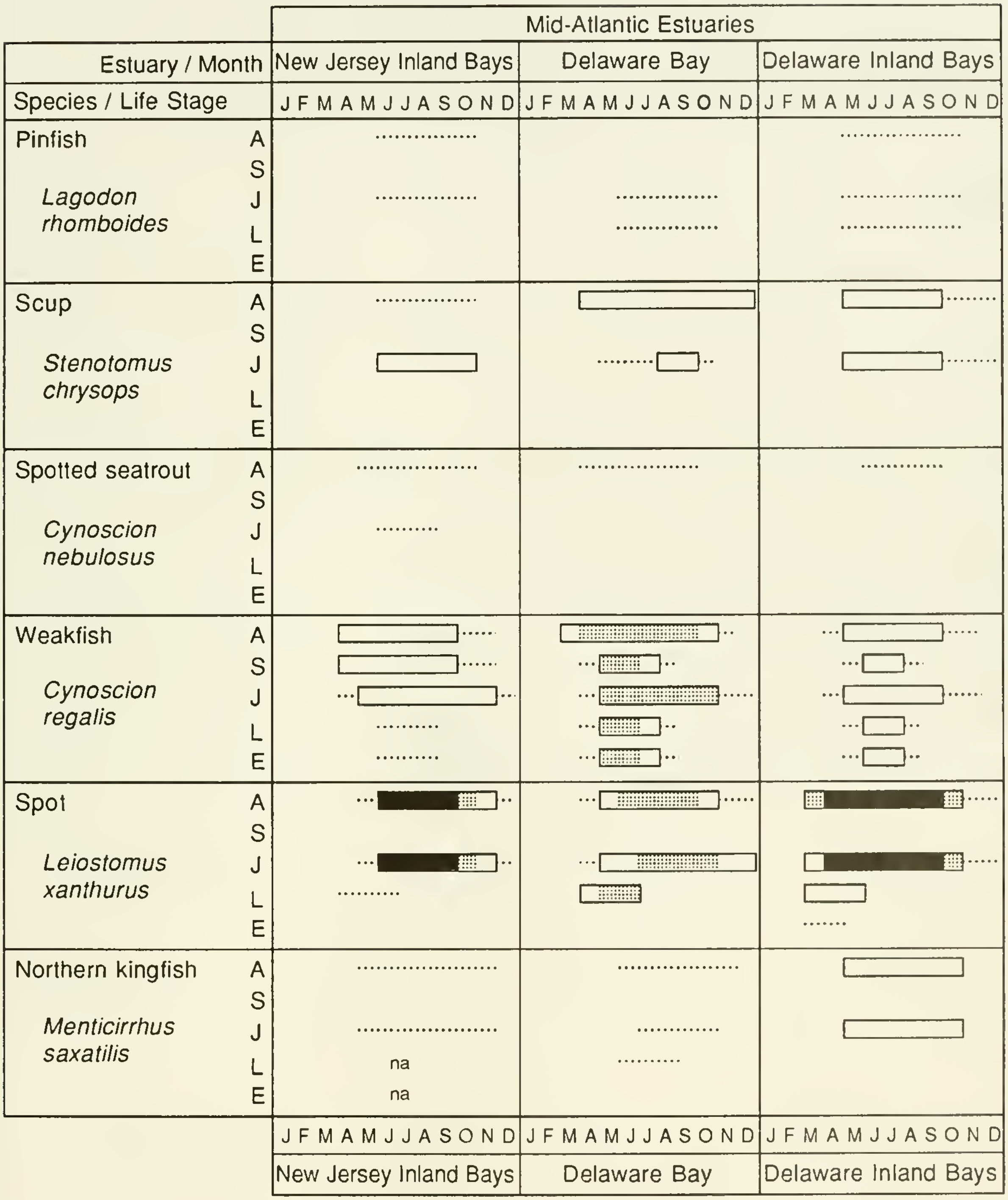
Relative Abundance

■	Highly Abundant
▨	Abundant
☐	Common
·········	Rare
Blank	Not Present
na	No Data Available

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs

Table 5, continued. Temporal distribution



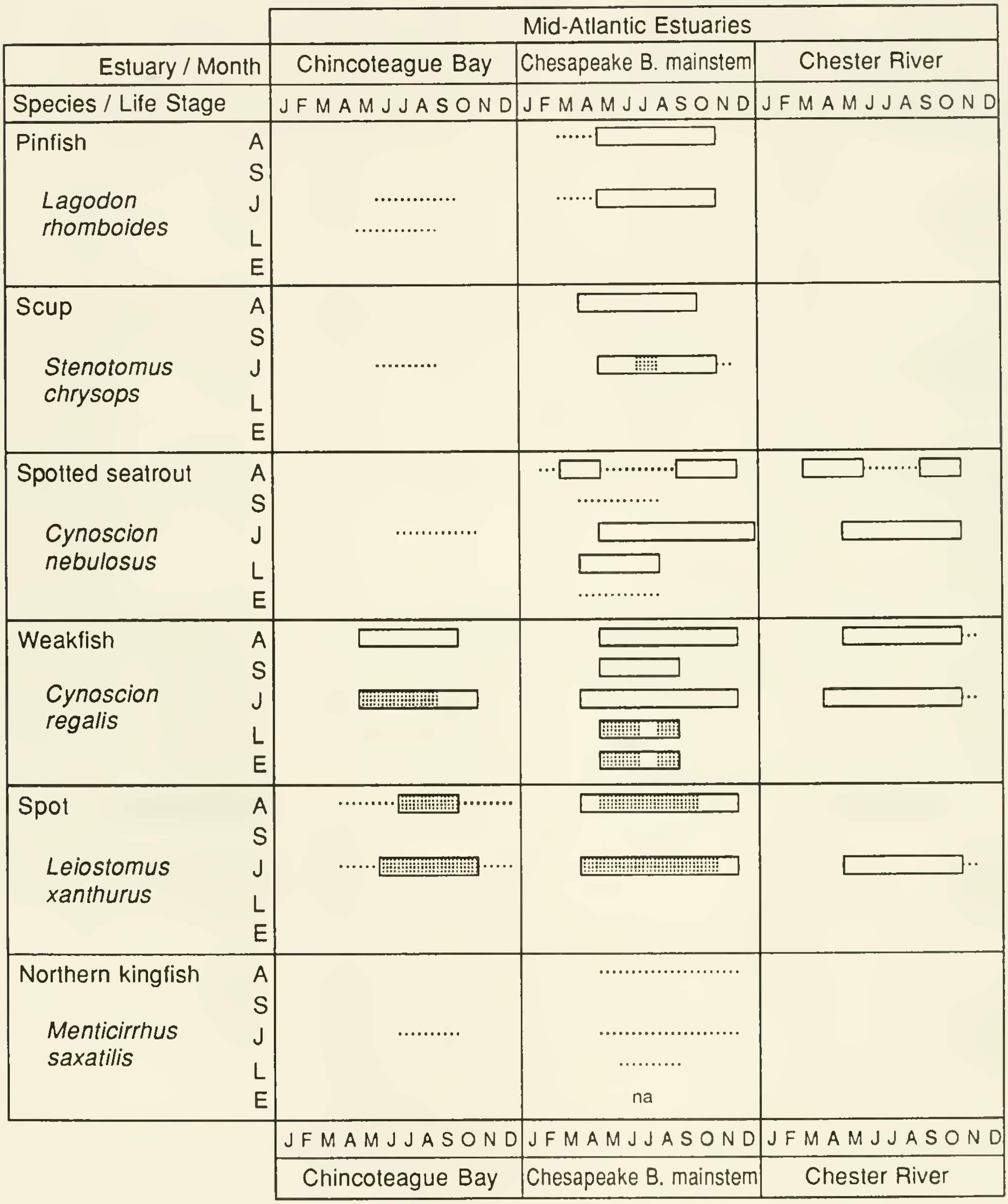
Relative Abundance

■	Highly Abundant
▨	Abundant
☐	Common
·········	Rare
Blank	Not Present
na	No Data Available

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs

Table 5, continued. Temporal distribution



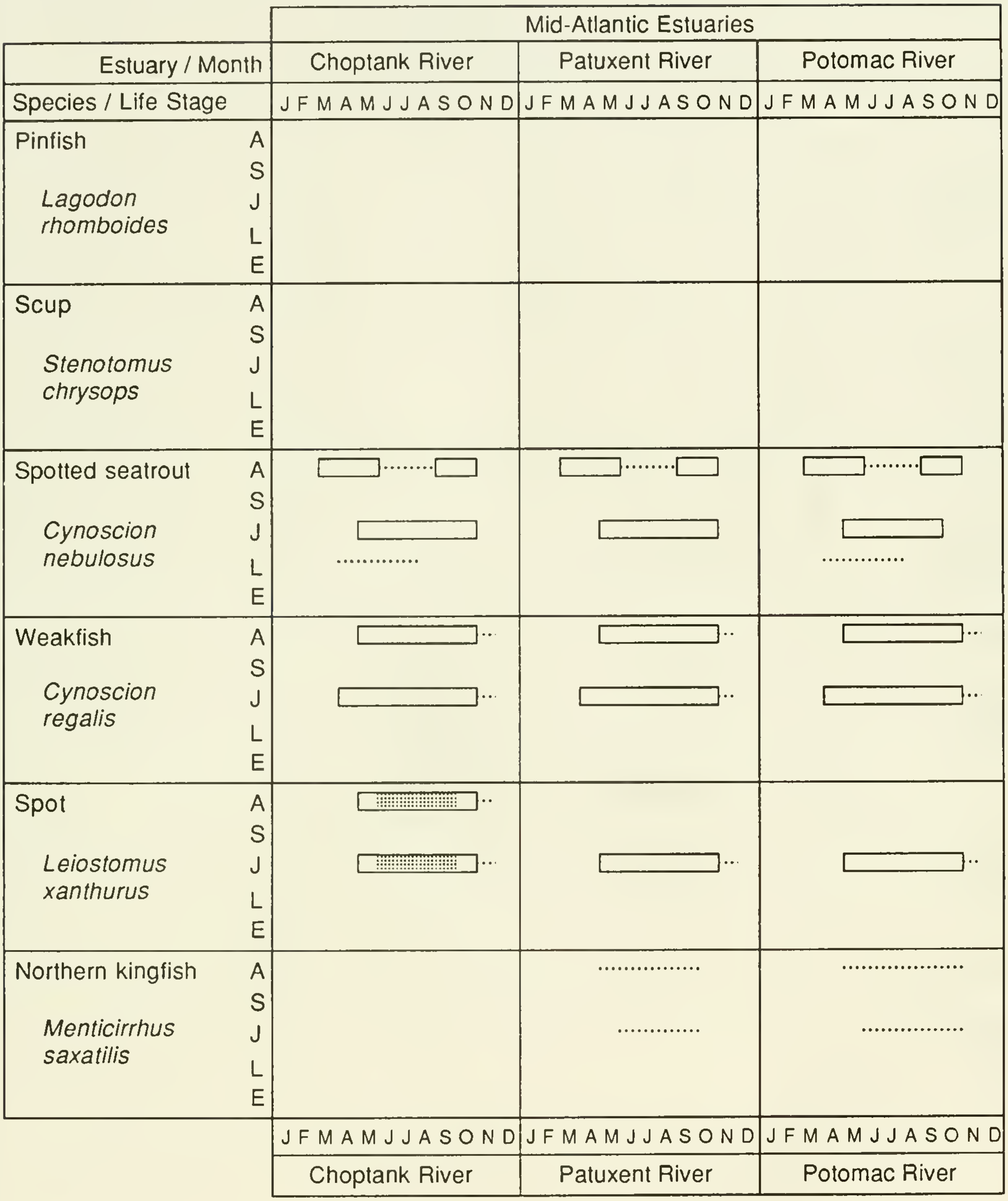
Relative Abundance

■	Highly Abundant
▨	Abundant
☐	Common
………	Rare
Blank	Not Present

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs

Table 5, continued. Temporal distribution



Relative Abundance

■ Highly Abundant

▨ Abundant

☐ Common

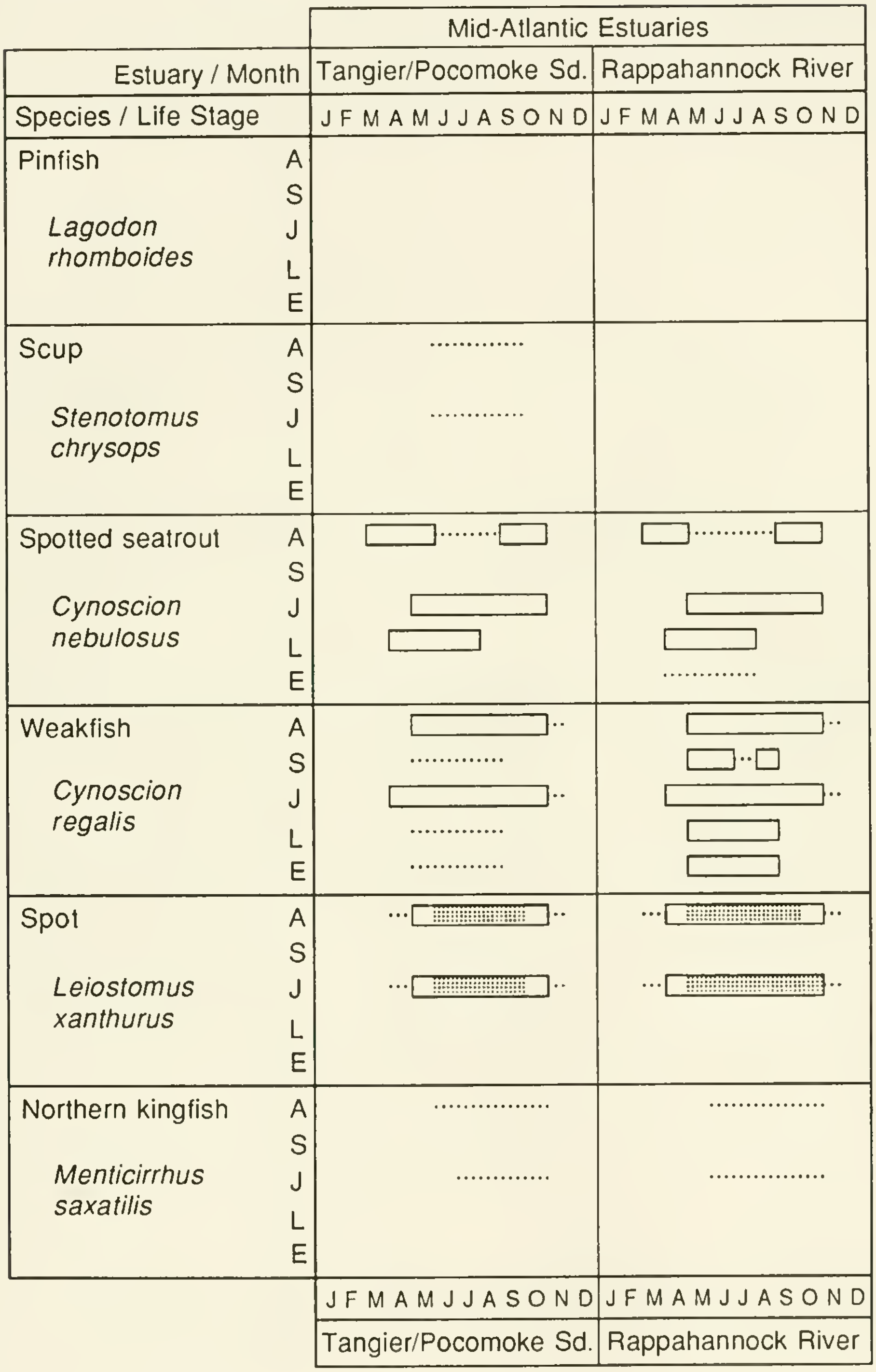
········ Rare

Blank Not Present

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs

Table 5, continued. Temporal distribution



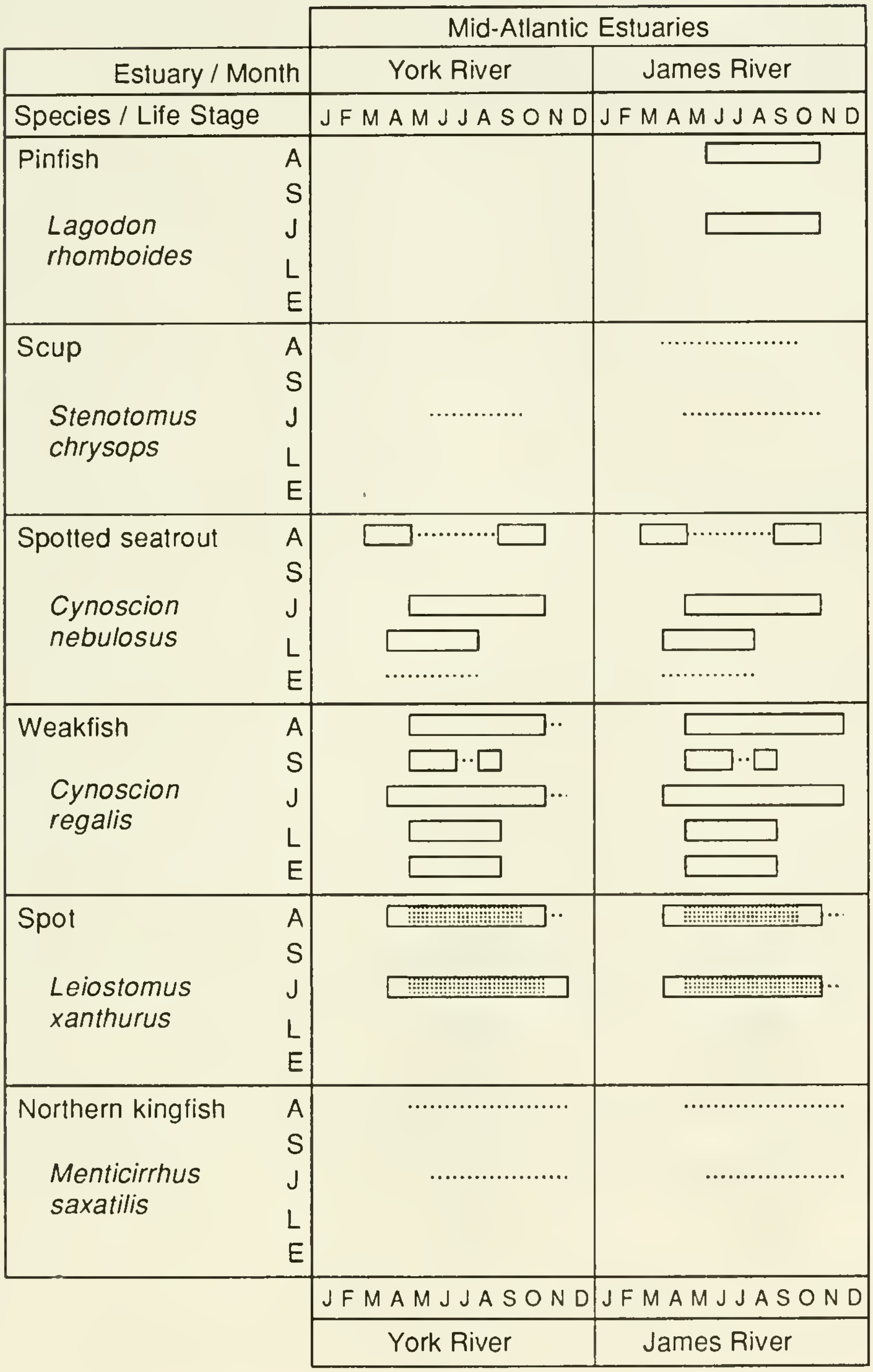
Relative Abundance

■	Highly Abundant
▨	Abundant
▭	Common
………	Rare
Blank	Not Present

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs

Table 5, continued. Temporal distribution



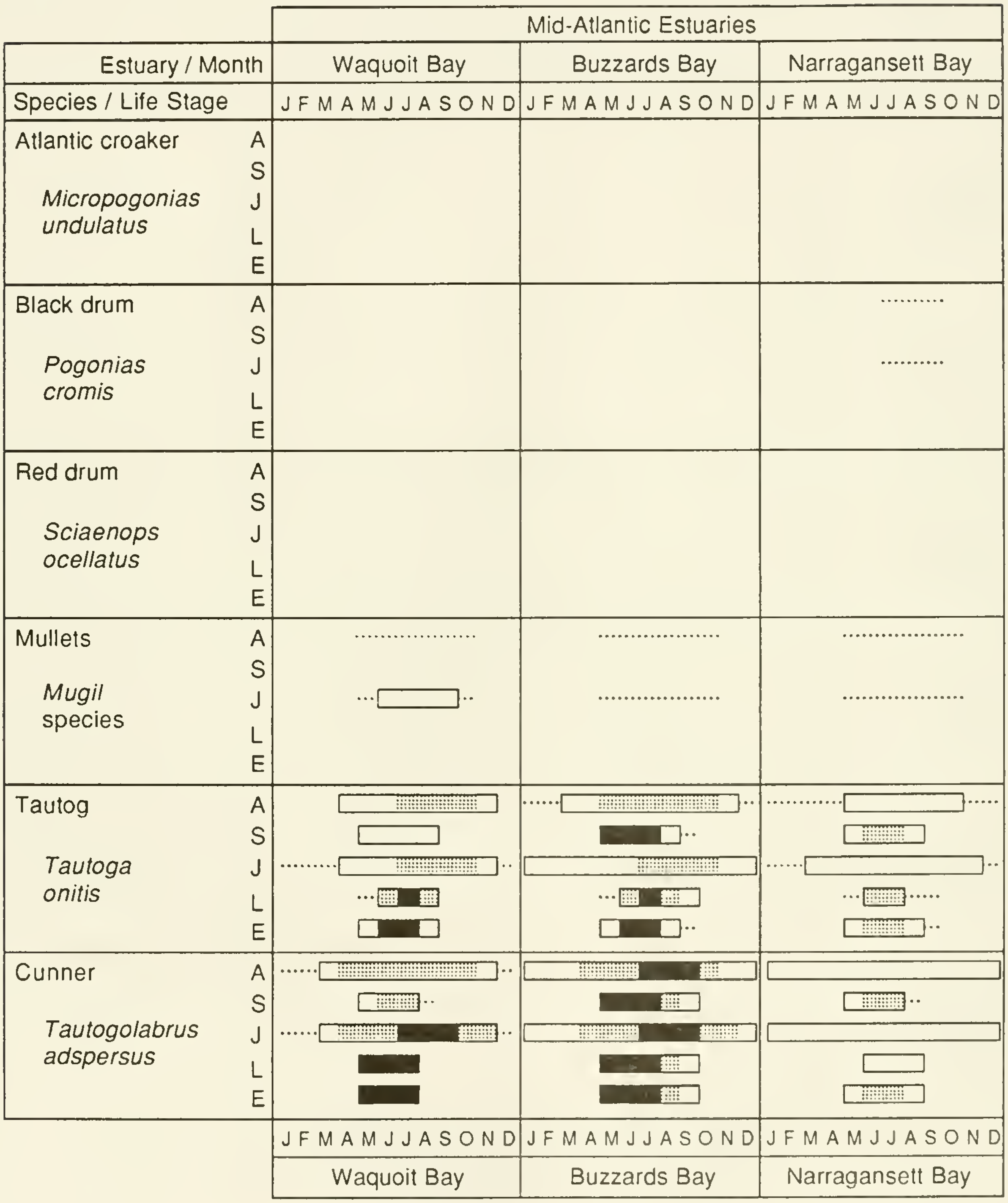
Relative Abundance

■	Highly Abundant
▨	Abundant
▭	Common
....	Rare
Blank	Not Present

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs

Table 5, continued. Temporal distribution



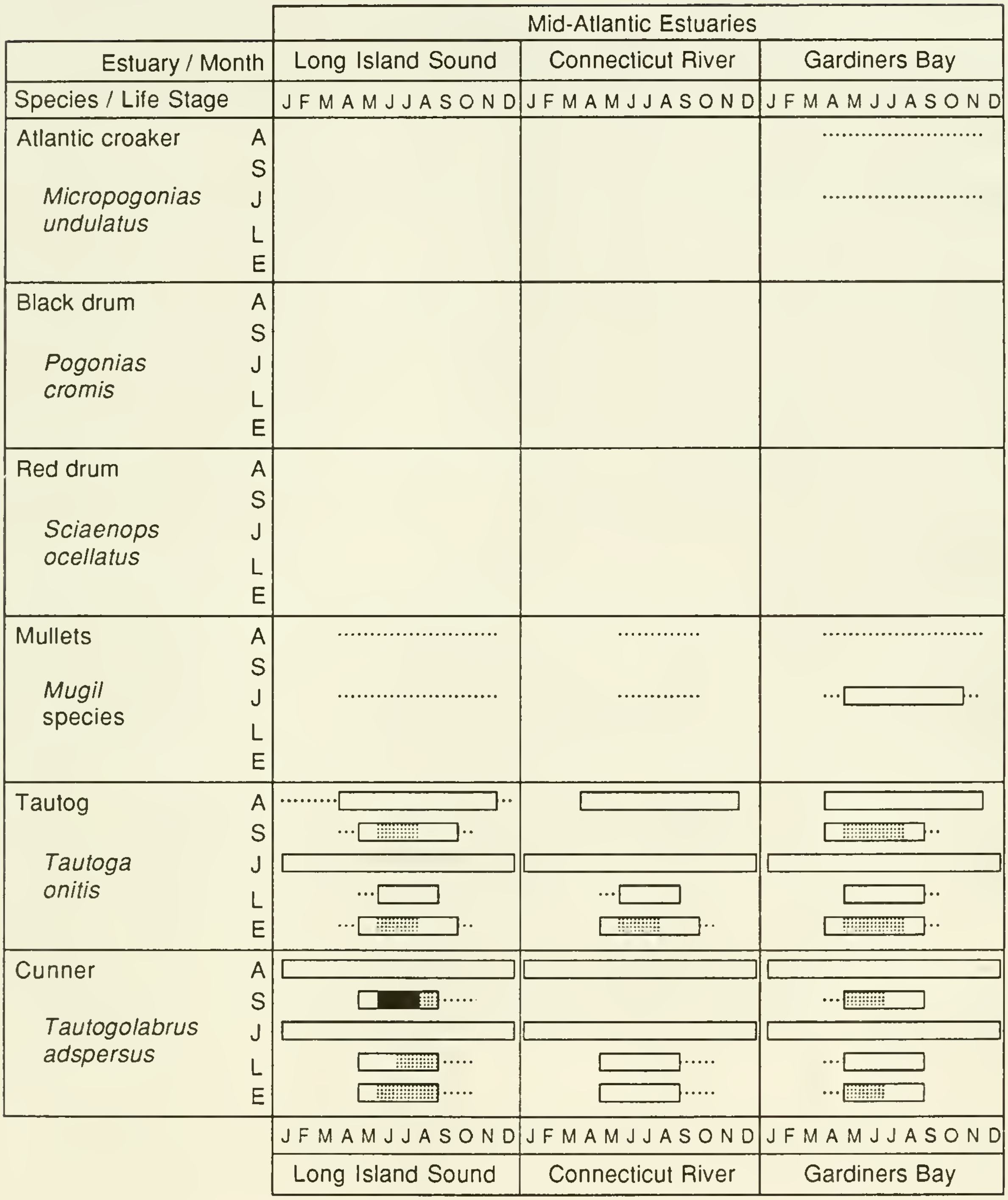
Relative Abundance

■	Highly Abundant
▨	Abundant
▭	Common
⋯⋯	Rare
Blank	Not Present

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs

Table 5, continued. Temporal distribution



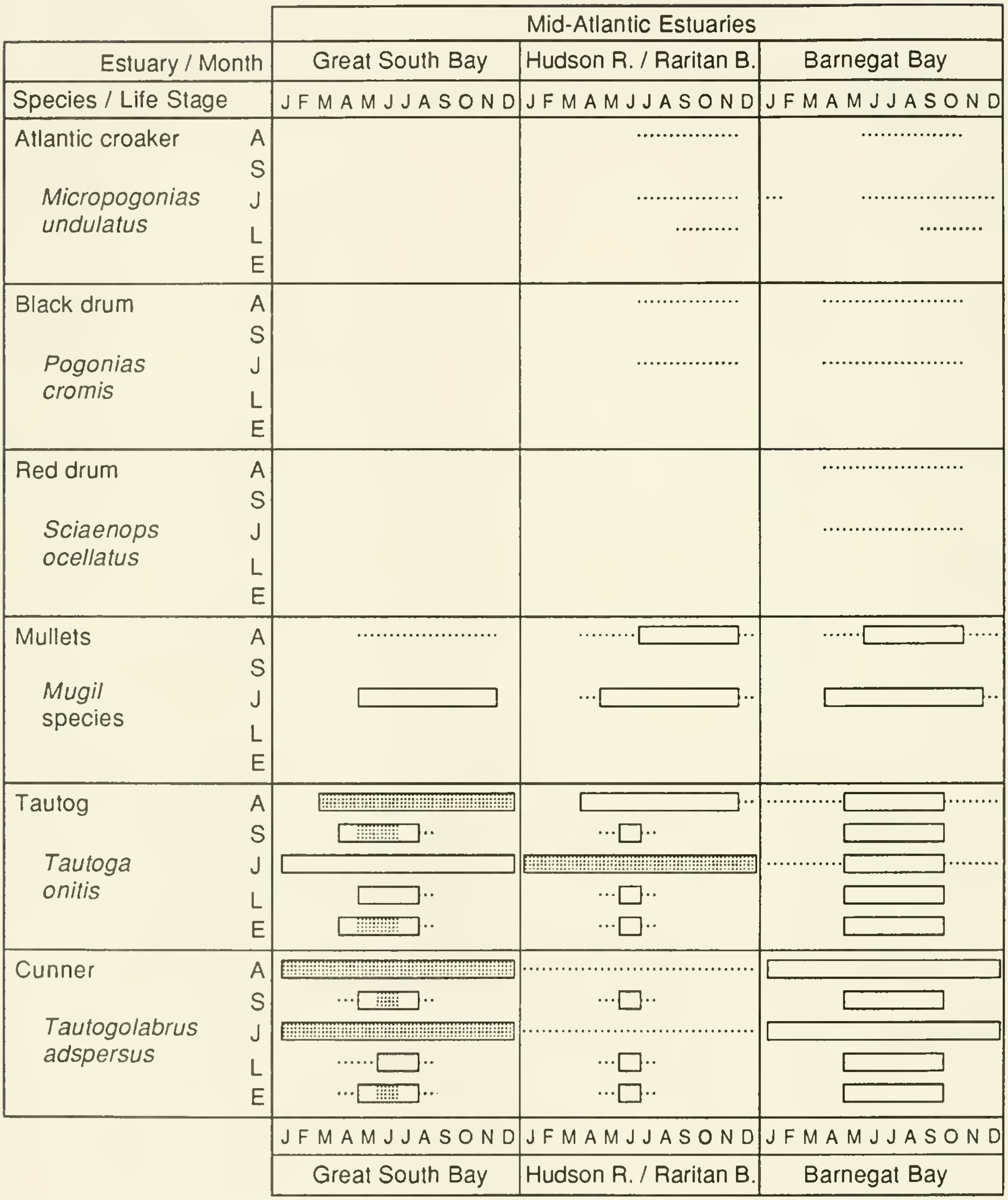
Relative Abundance

■	Highly Abundant
▨	Abundant
▭	Common
········	Rare
Blank	Not Present

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs

Table 5, continued. Temporal distribution



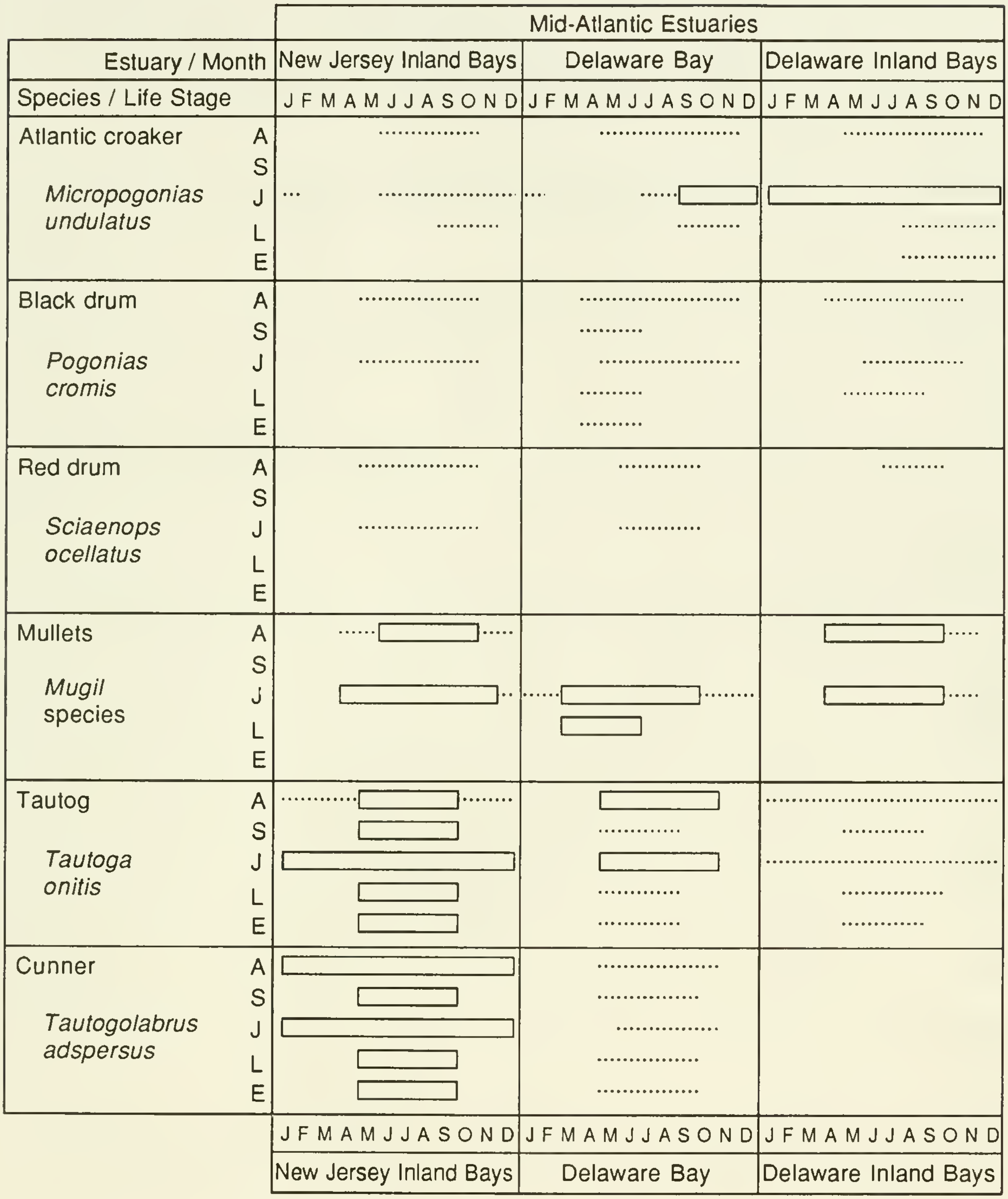
Relative Abundance

■ Highly Abundant
▨ Abundant
☐ Common
········ Rare
Blank Not Present

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs

Table 5, continued. Temporal distribution



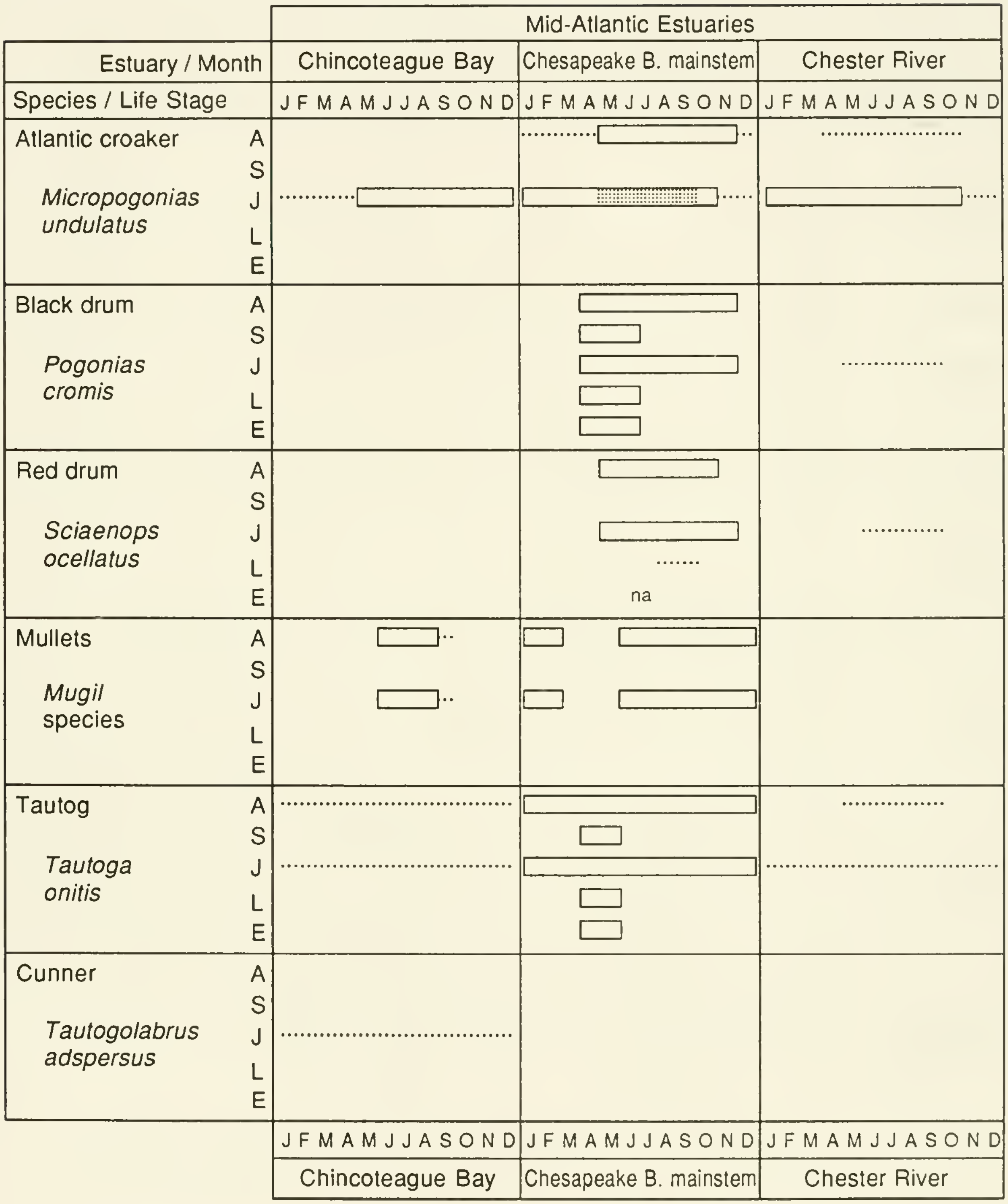
Relative Abundance

■	Highly Abundant
▨	Abundant
▭	Common
....	Rare
Blank	Not Present

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs

Table 5, continued. Temporal distribution



Relative Abundance

■	Highly Abundant
▨	Abundant
▭	Common
………	Rare
Blank	Not Present
na	No Data Available

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs

Table 5, continued. Temporal distribution

		Mid-Atlantic Estuaries																																			
Estuary / Month		Choptank River												Patuxent River												Potomac River											
Species / Life Stage		J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
Atlantic croaker *Micropogonias undulatus*	A				⋯	⋯	⋯	⋯	⋯	⋯	⋯						⋯	⋯	⋯	⋯	⋯	⋯	⋯						⋯	⋯	⋯	⋯	⋯	⋯	⋯		
	S																																				
	J	▭	▭	▭	▭	▭	▭	▭	▭	▭	▭	⋯	⋯	▭	▭	▭	▭	▭	▭	▭	▭	▭	▭	⋯	⋯	▭	▭	▭	▭	▭	▭	▭	▭	▭	▭	⋯	⋯
	L																																				
	E																																				
Black drum *Pogonias cromis*	A					▭	▭	▭	▭	▭	⋯							⋯	⋯	⋯	⋯	⋯	⋯							▭	▭	▭	▭	▭	▭		
	S																																				
	J					▭	▭	▭	▭	▭	⋯							⋯	⋯	⋯	⋯	⋯	⋯							▭	▭	▭	▭	▭	▭		
	L																																				
	E																																				
Red drum *Sciaenops ocellatus*	A						⋯	⋯	⋯	⋯									⋯	⋯	⋯	⋯	⋯								▭	▭	▭	▭	▭		
	S																																				
	J						⋯	⋯	⋯	⋯									⋯	⋯	⋯	⋯	⋯								▭	▭	▭	▭	▭	▭	
	L																																				
	E																																				
Mullets *Mugil* species	A																		⋯	⋯	⋯	⋯	⋯								⋯	⋯	⋯	⋯	⋯		
	S																																				
	J																		⋯	⋯	⋯	⋯	⋯								⋯	⋯	⋯	⋯	⋯		
	L																																				
	E																																				
Tautog *Tautoga onitis*	A					⋯	⋯	⋯	⋯	⋯								⋯	⋯	⋯	⋯	⋯								⋯	⋯	⋯	⋯	⋯			
	S																																				
	J	⋯	⋯	⋯	⋯	⋯	⋯	⋯	⋯	⋯	⋯	⋯	⋯	⋯	⋯	⋯	⋯	⋯	⋯	⋯	⋯	⋯	⋯	⋯	⋯	⋯	⋯	⋯	⋯	⋯	⋯	⋯	⋯	⋯	⋯	⋯	⋯
	L																																				
	E																																				
Cunner *Tautogolabrus adspersus*	A																																				
	S																																				
	J																																				
	L																																				
	E																																				
		J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
		Choptank River												Patuxent River												Potomac River											

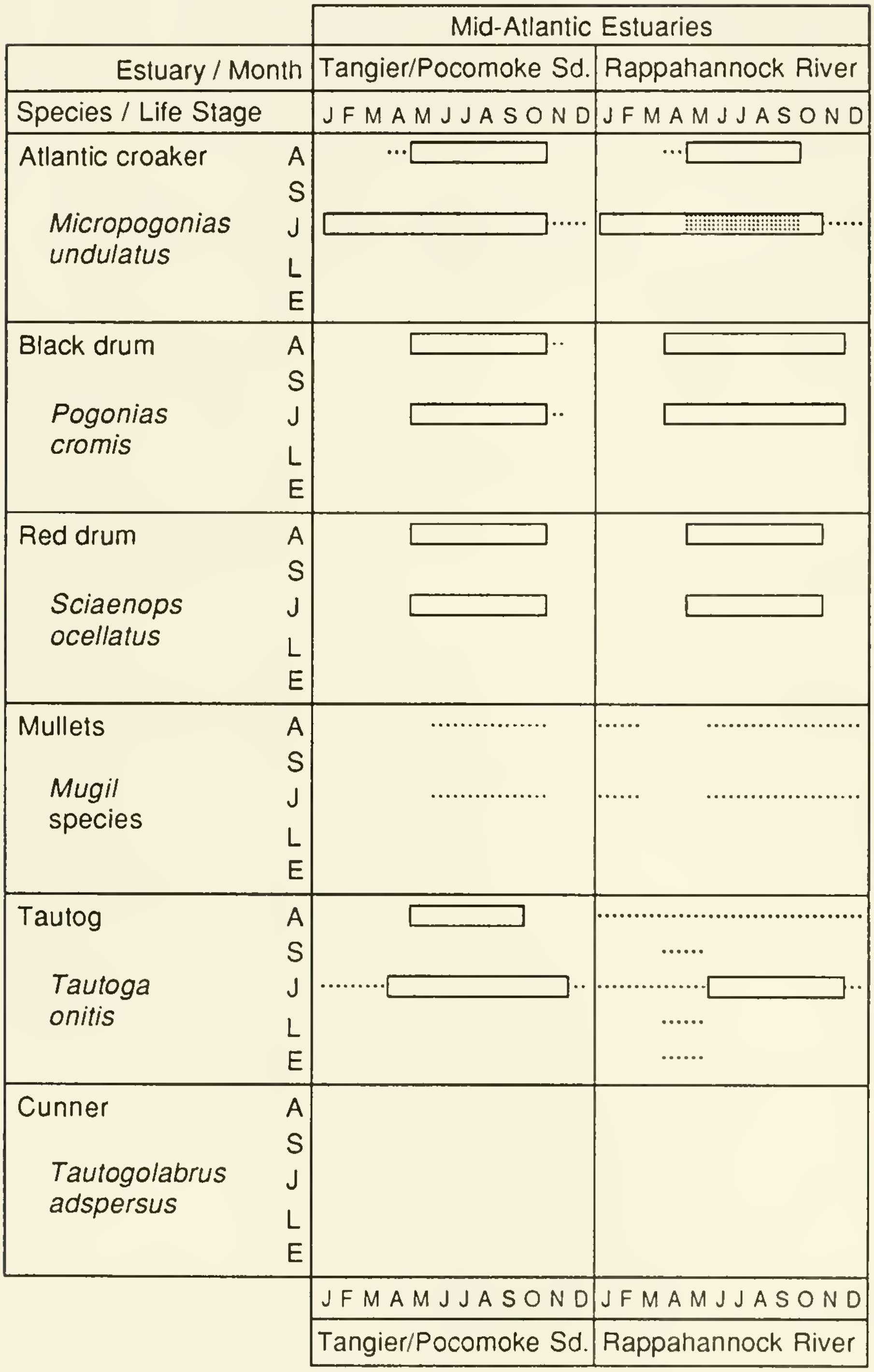
Relative Abundance

█	Highly Abundant
▨	Abundant
▭	Common
⋯	Rare
Blank	Not Present

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs

Table 5, continued. Temporal distribution



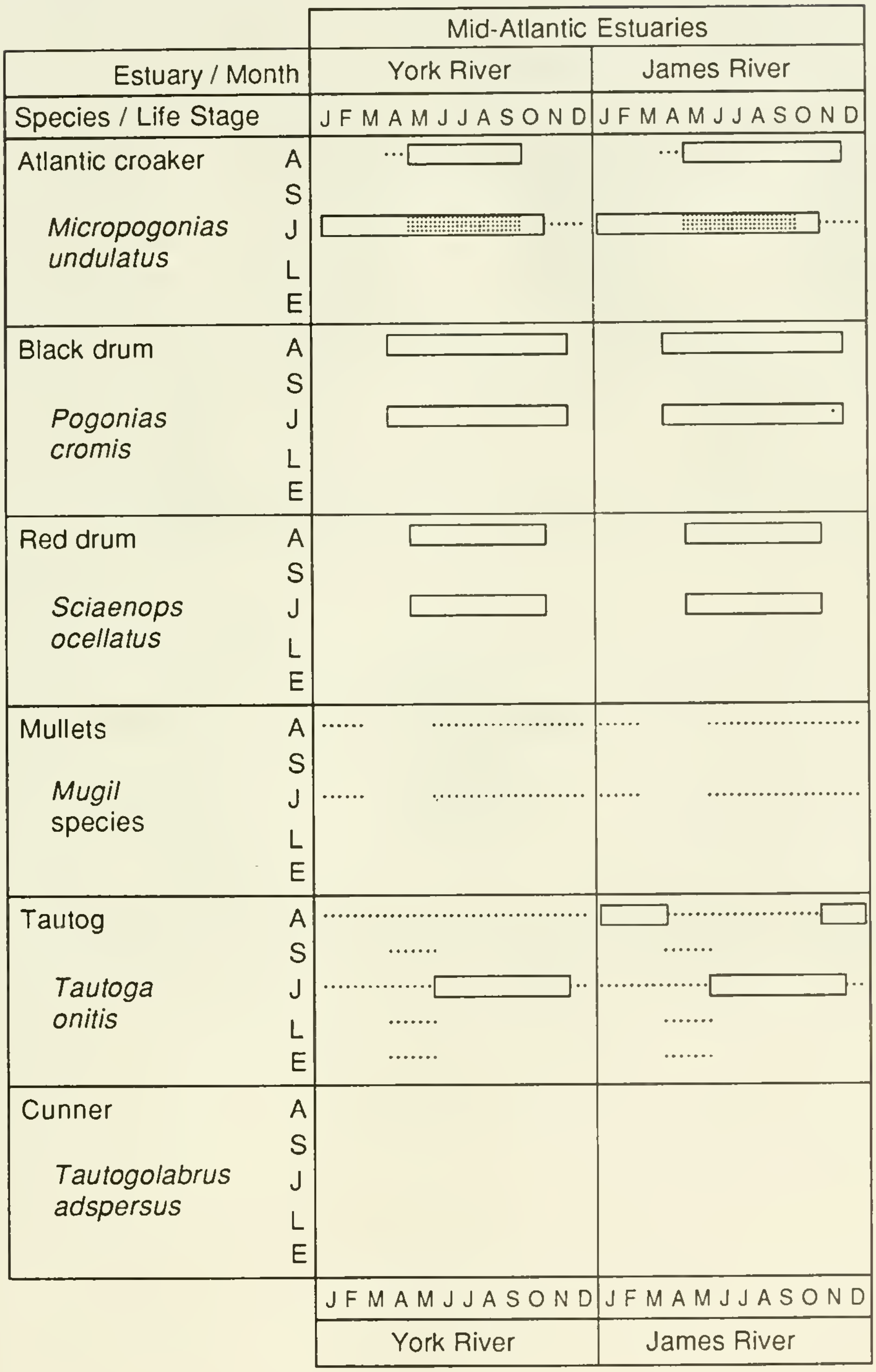
Relative Abundance

■	Highly Abundant
▨	Abundant
☐	Common
········	Rare
Blank	Not Present

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs

Table 5, continued. Temporal distribution

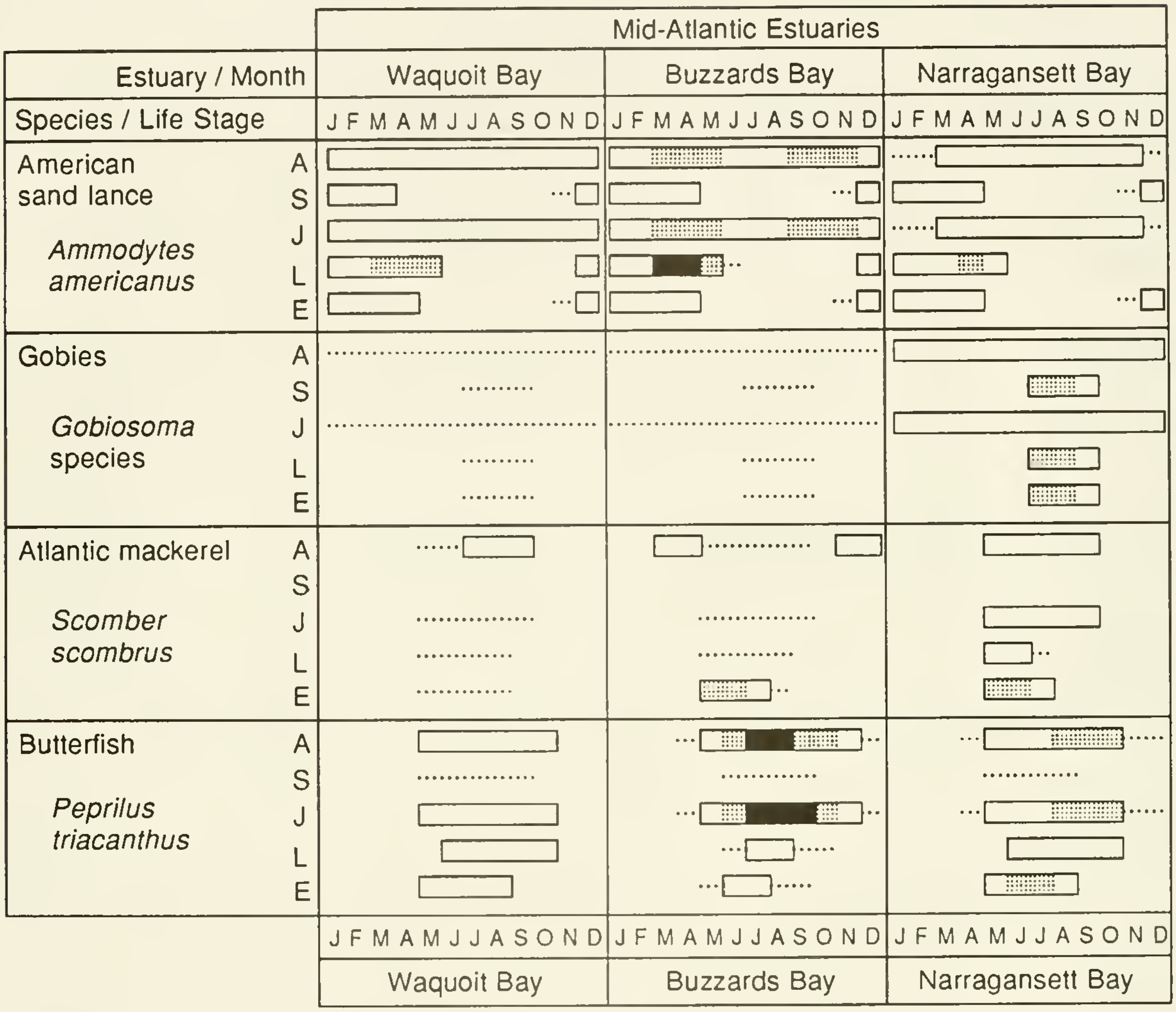


Relative Abundance	
■	Highly Abundant
▨	Abundant
☐	Common
········	Rare
Blank	Not Present

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs

Table 5, continued. Temporal distribution



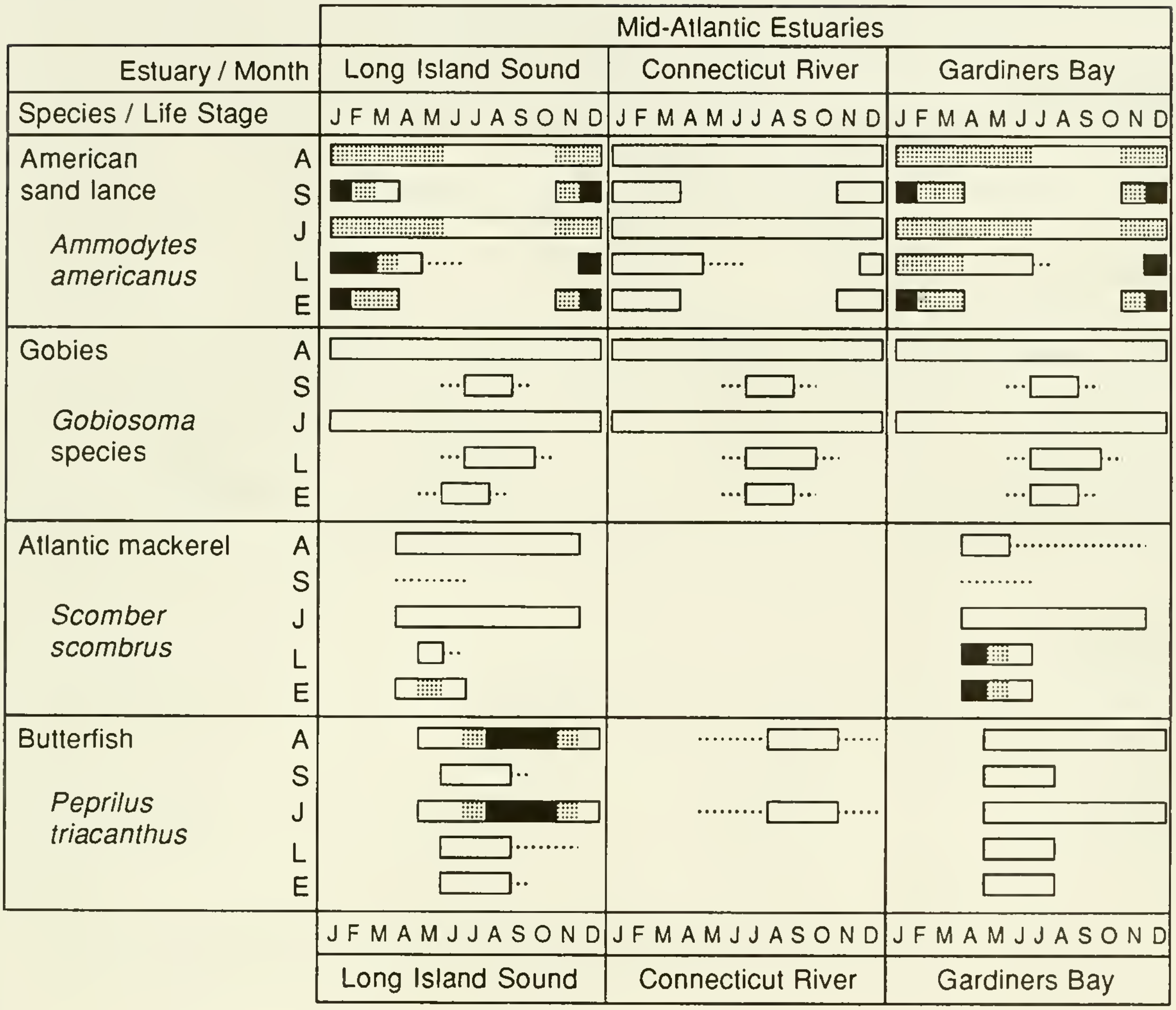
Relative Abundance

■	Highly Abundant
▨	Abundant
□	Common
·········	Rare
Blank	Not Present

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs

Table 5, continued. Temporal distribution



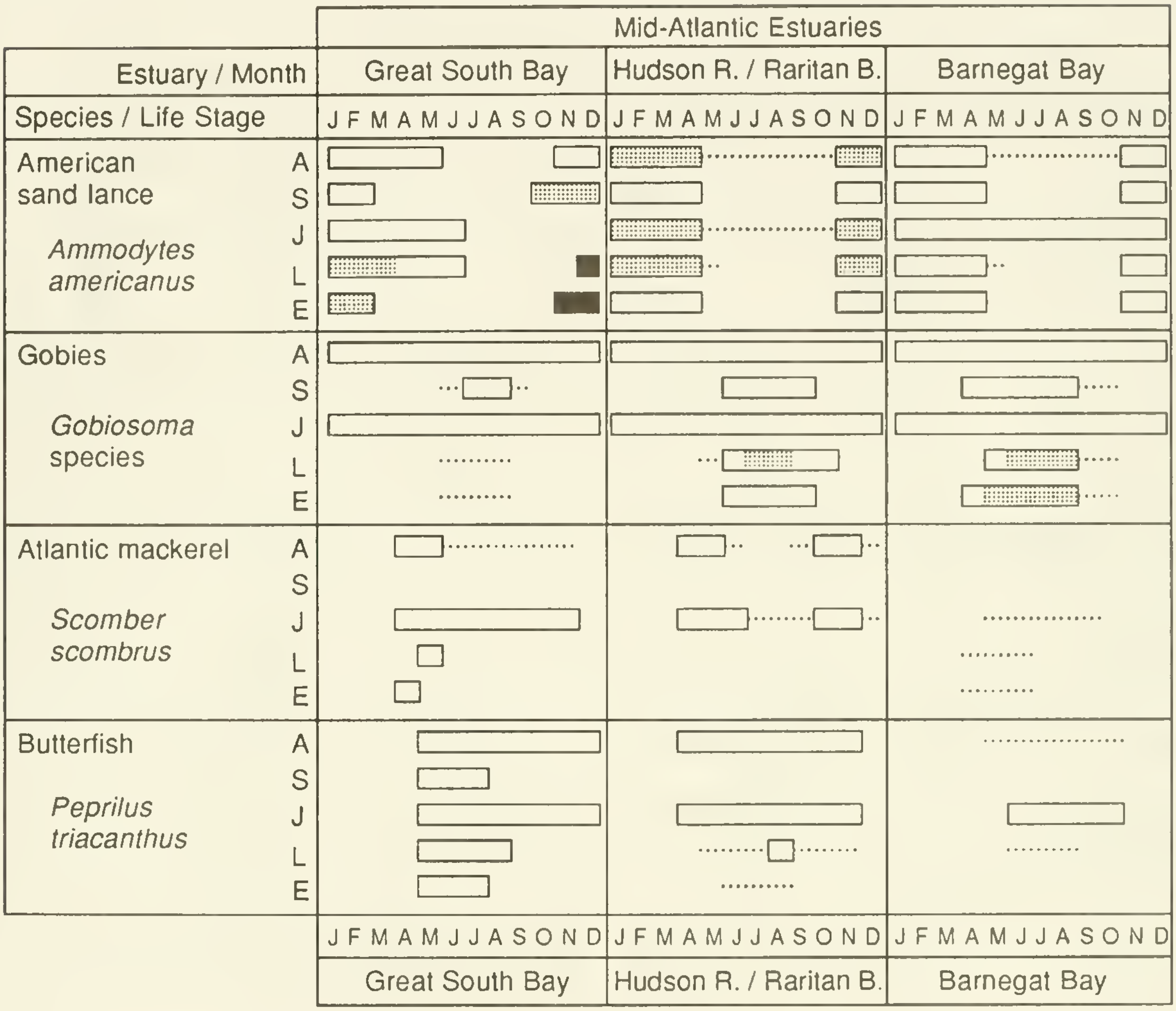
Relative Abundance

■	Highly Abundant
▨	Abundant
▭	Common
....	Rare
Blank	Not Present

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs

Table 5, continued. Temporal distribution



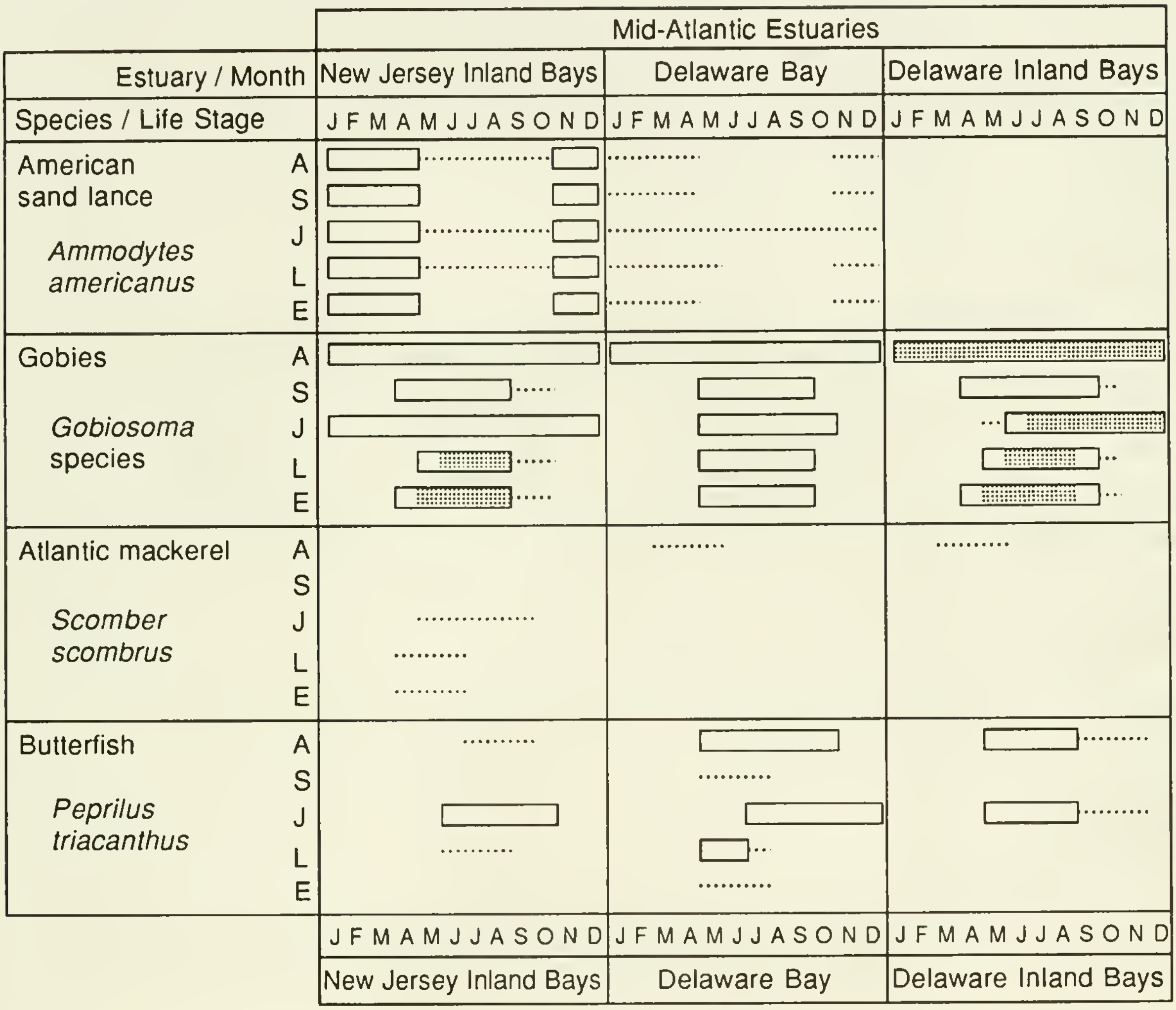
Relative Abundance

■	Highly Abundant
▨	Abundant
☐	Common
········	Rare
Blank	Not Present

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs

Table 5, continued. Temporal distribution



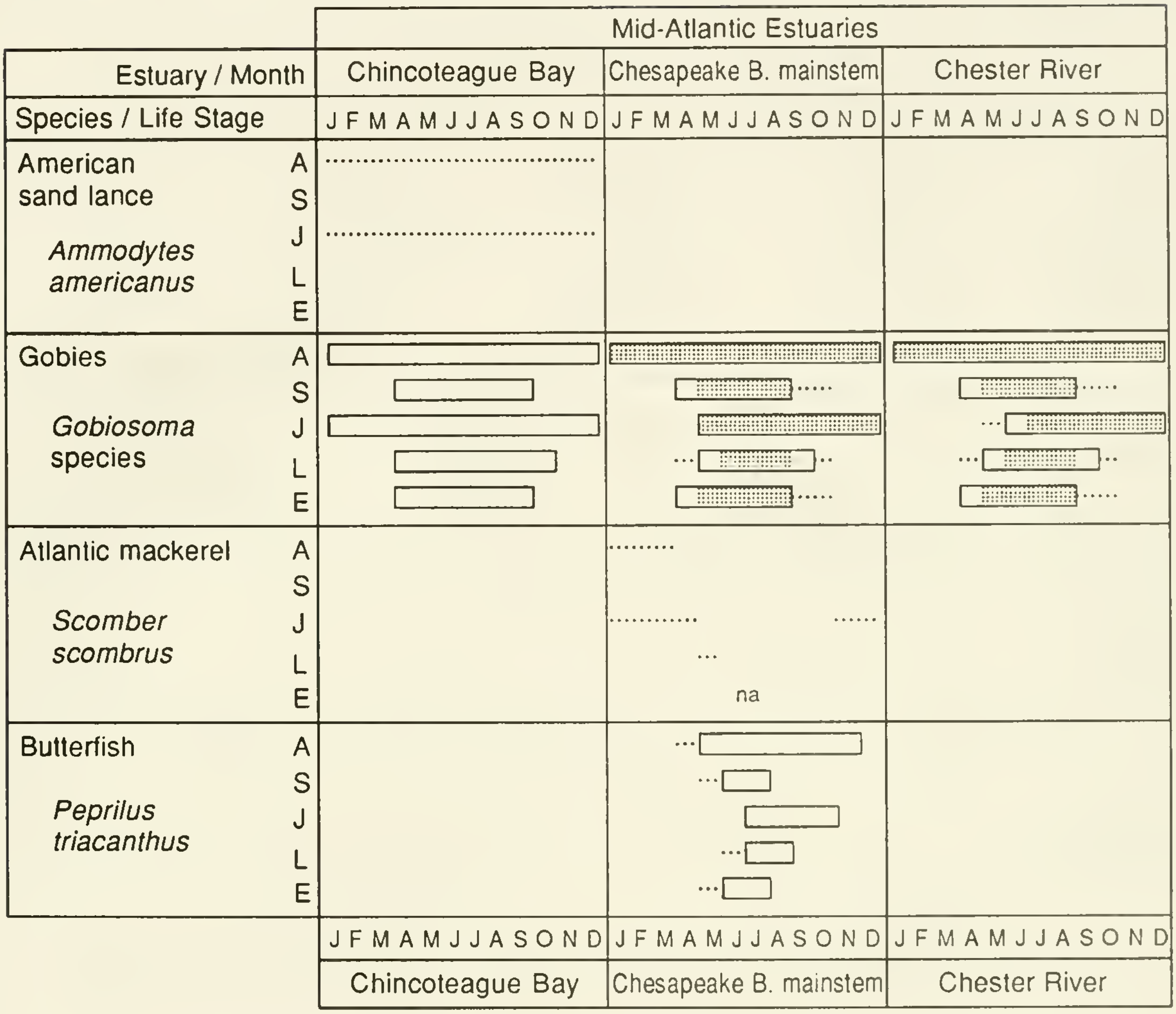
Relative Abundance

■	Highly Abundant
▨	Abundant
☐	Common
········	Rare
Blank	Not Present

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs

Table 5, continued. Temporal distribution



Relative Abundance

■	Highly Abundant
▨	Abundant
☐	Common
....	Rare
Blank	Not Present
na	No Data Available

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs

Table 5, continued. Temporal distribution

Mid-Atlantic Estuaries

Estuary / Month		Choptank River											
Species / Life Stage		J	F	M	A	M	J	J	A	S	O	N	D
American sand lance *Ammodytes americanus*	A												
	S												
	J												
	L												
	E												
Gobies *Gobiosoma* species	A	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨
	S				☐	▨	▨	▨	▨	······	······		
	J					······	☐	▨	▨	▨	▨	▨	▨
	L				······	☐	▨	▨	▨	☐	······		
	E				☐	▨	▨	▨	▨	······	······		
Atlantic mackerel *Scomber scombrus*	A												
	S												
	J												
	L												
	E												
Butterfish *Peprilus triacanthus*	A						······	······	······	······			
	S												
	J							······	······	······			
	L												
	E												

Estuary / Month		Patuxent River											
Species / Life Stage		J	F	M	A	M	J	J	A	S	O	N	D
American sand lance *Ammodytes americanus*	A												
	S												
	J												
	L												
	E												
Gobies *Gobiosoma* species	A	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨
	S				☐	▨	▨	▨	▨	······	······		
	J					······	☐	▨	▨	▨	▨	▨	▨
	L				······	☐	▨	▨	▨	☐	······		
	E				☐	▨	▨	▨	▨	······	······		
Atlantic mackerel *Scomber scombrus*	A												
	S												
	J												
	L												
	E												
Butterfish *Peprilus triacanthus*	A						······	······	······	······			
	S												
	J							······	······	······			
	L												
	E												

Estuary / Month		Potomac River											
Species / Life Stage		J	F	M	A	M	J	J	A	S	O	N	D
American sand lance *Ammodytes americanus*	A												
	S												
	J												
	L												
	E												
Gobies *Gobiosoma* species	A	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨
	S				☐	▨	▨	▨	▨	······	······		
	J					······	☐	▨	▨	▨	▨	▨	▨
	L				······	☐	▨	▨	▨	☐	······		
	E				☐	▨	▨	▨	▨	······	······		
Atlantic mackerel *Scomber scombrus*	A												
	S												
	J												
	L												
	E												
Butterfish *Peprilus triacanthus*	A					······	······	······	······	······	······		
	S												
	J						······	······	······	······	······		
	L												
	E												

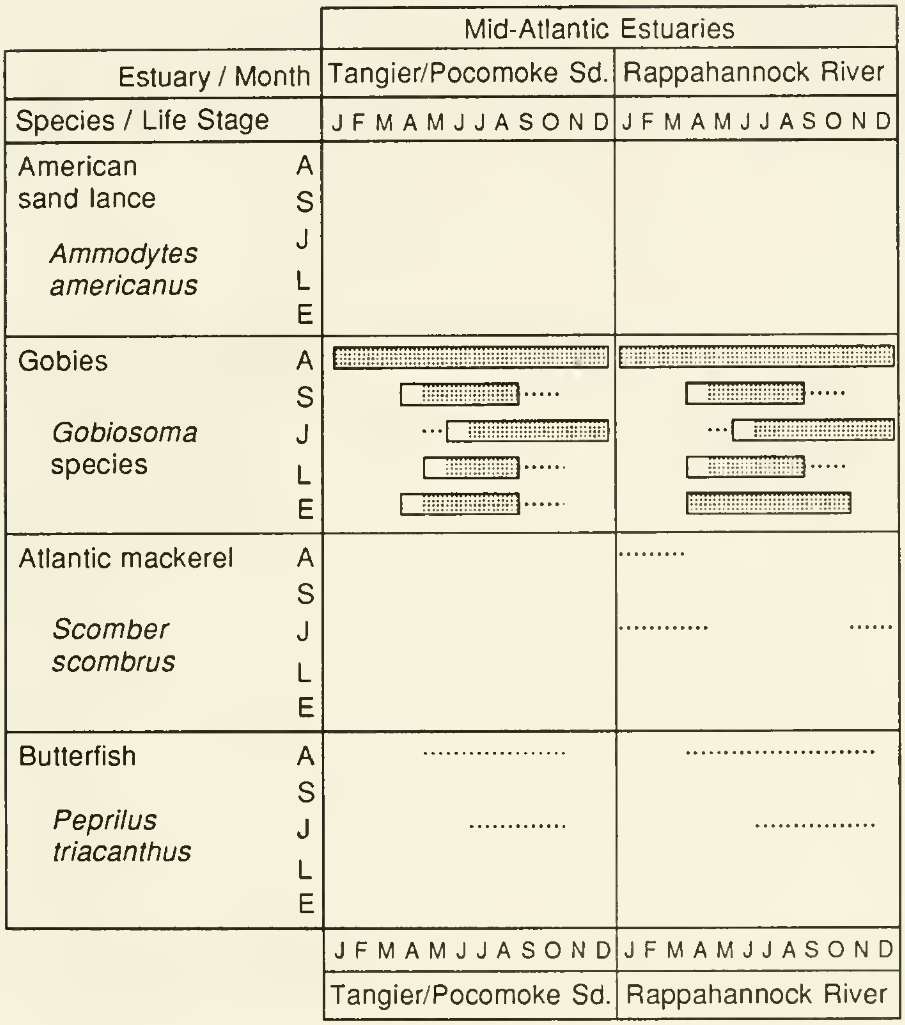
Relative Abundance

■	Highly Abundant
▨	Abundant
☐	Common
·········	Rare
Blank	Not Present

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs

Table 5, continued. Temporal distribution



Relative Abundance

■ Highly Abundant

▨ Abundant

☐ Common

.... Rare

Blank Not Present

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs

Table 5, continued. Temporal distribution

		Mid-Atlantic Estuaries																							
Estuary / Month		York River												James River											
Species / Life Stage		J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
American sand lance *Ammodytes americanus*	A																								
	S																								
	J																								
	L																								
	E																								
Gobies *Gobiosoma* species	A	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨
	S				☐	▨	▨	▨	▨	···	···						☐	▨	▨	▨	▨	···	···		
	J	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨					···	☐	▨	▨	▨	▨	▨	▨
	L				···	☐	▨	▨	▨	···	···						···	☐	▨	▨	▨	···	···		
	E				☐	▨	▨	▨	▨	···	···						☐	▨	▨	▨	▨	···	···		
Atlantic mackerel *Scomber scombrus*	A	···	···	···										···	···	···									
	S																								
	J	···	···	···	···							···	···	···	···	···	···							···	···
	L																								
	E																								
Butterfish *Peprilus triacanthus*	A				···	☐	☐	☐	☐	☐	☐	☐					···	☐	☐	☐	☐	☐	☐	☐	
	S																								
	J							☐	☐	☐	☐	☐								☐	☐	☐	☐	☐	
	L																								
	E																								
		J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
		York River												James River											

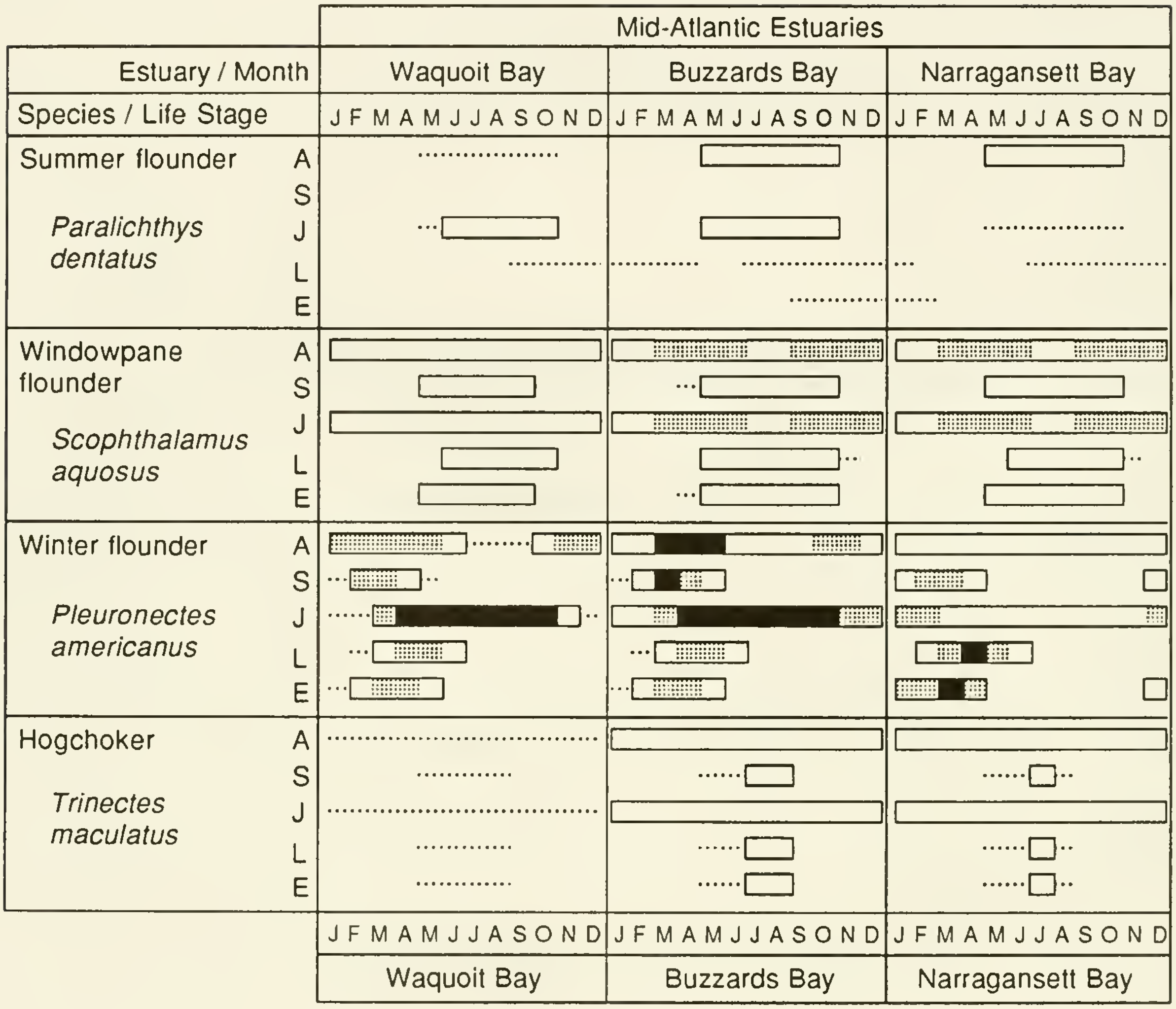
Relative Abundance

■	Highly Abundant
▨	Abundant
☐	Common
········	Rare
Blank	Not Present

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs

Table 5, continued. Temporal distribution



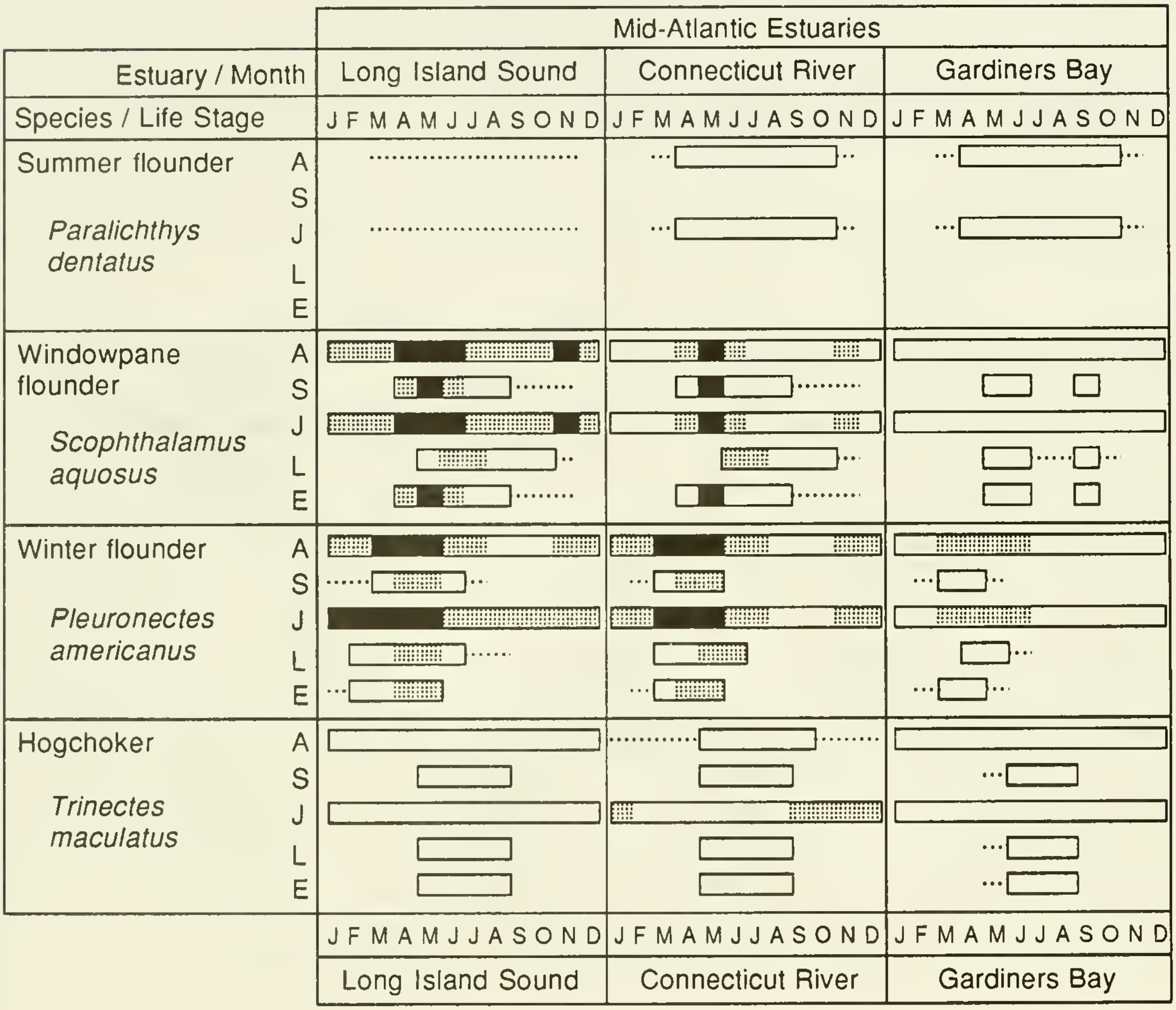
Relative Abundance

■	Highly Abundant
▨	Abundant
▭	Common
········	Rare
Blank	Not Present

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs

Table 5, continued. Temporal distribution



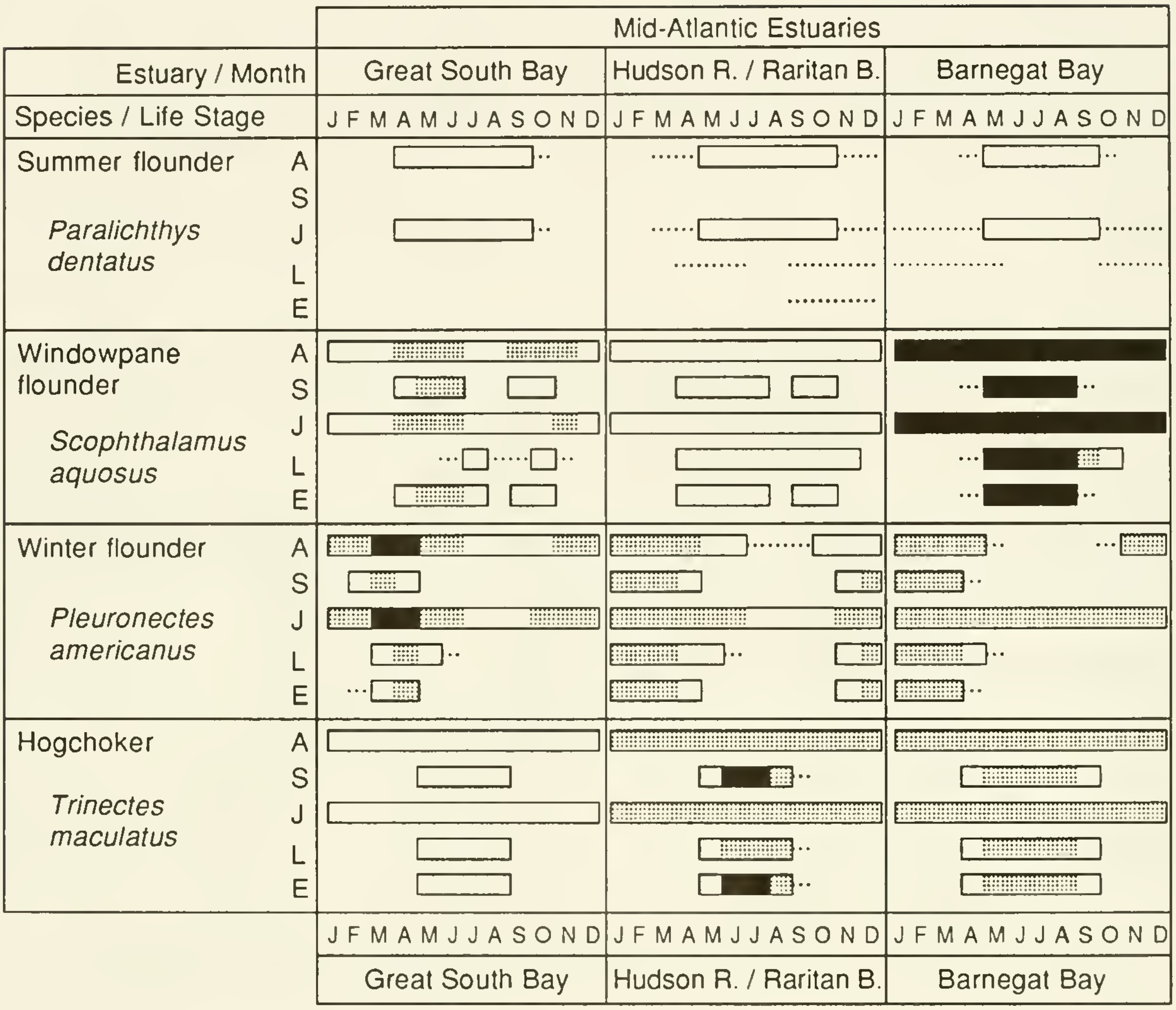
Relative Abundance

■	Highly Abundant
▨	Abundant
☐	Common
....	Rare
Blank	Not Present

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs

Table 5, continued. Temporal distribution

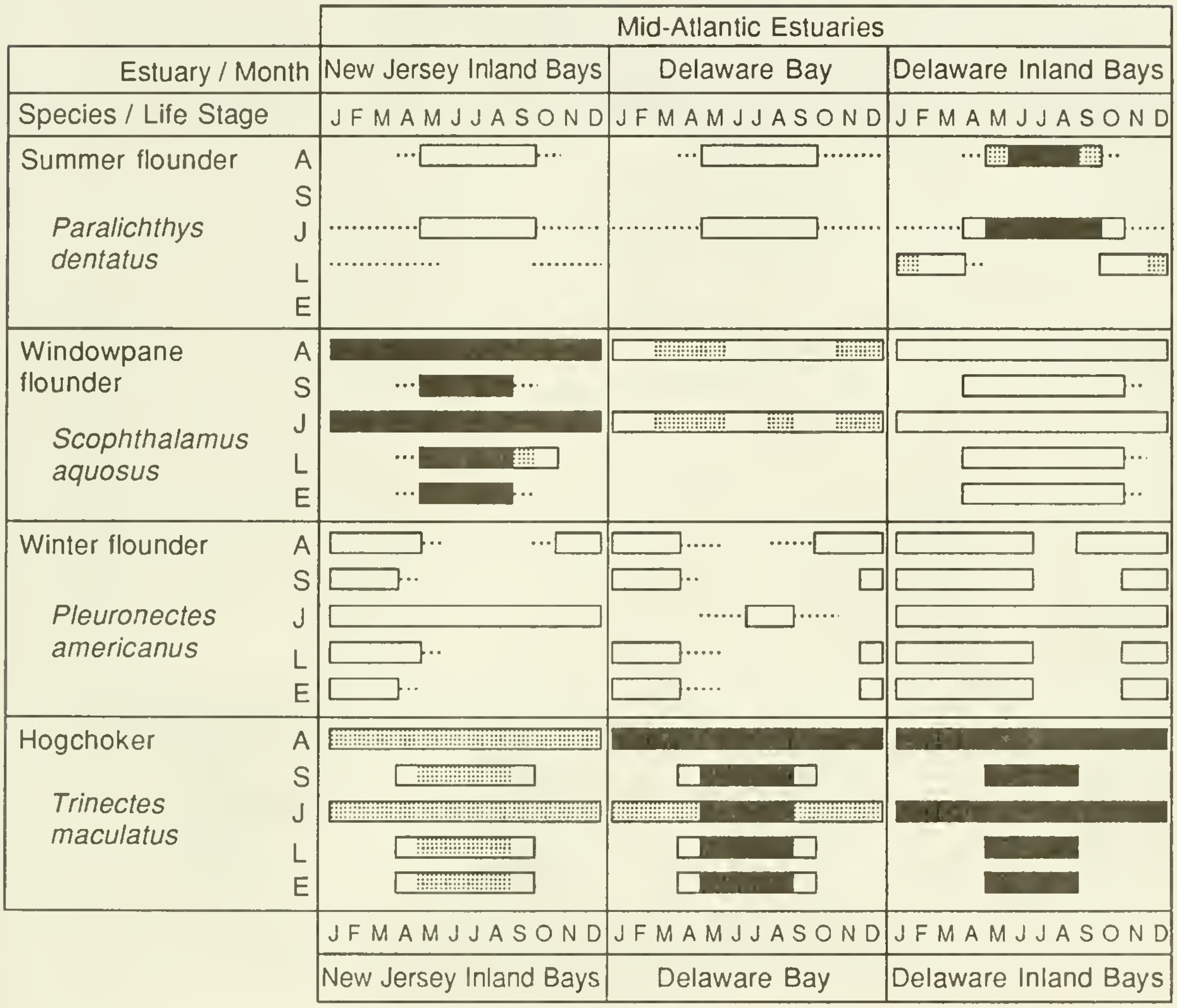


Relative Abundance	
▬	Highly Abundant
▨	Abundant
☐	Common
········	Rare
Blank	Not Present

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs

Table 5, continued. Temporal distribution



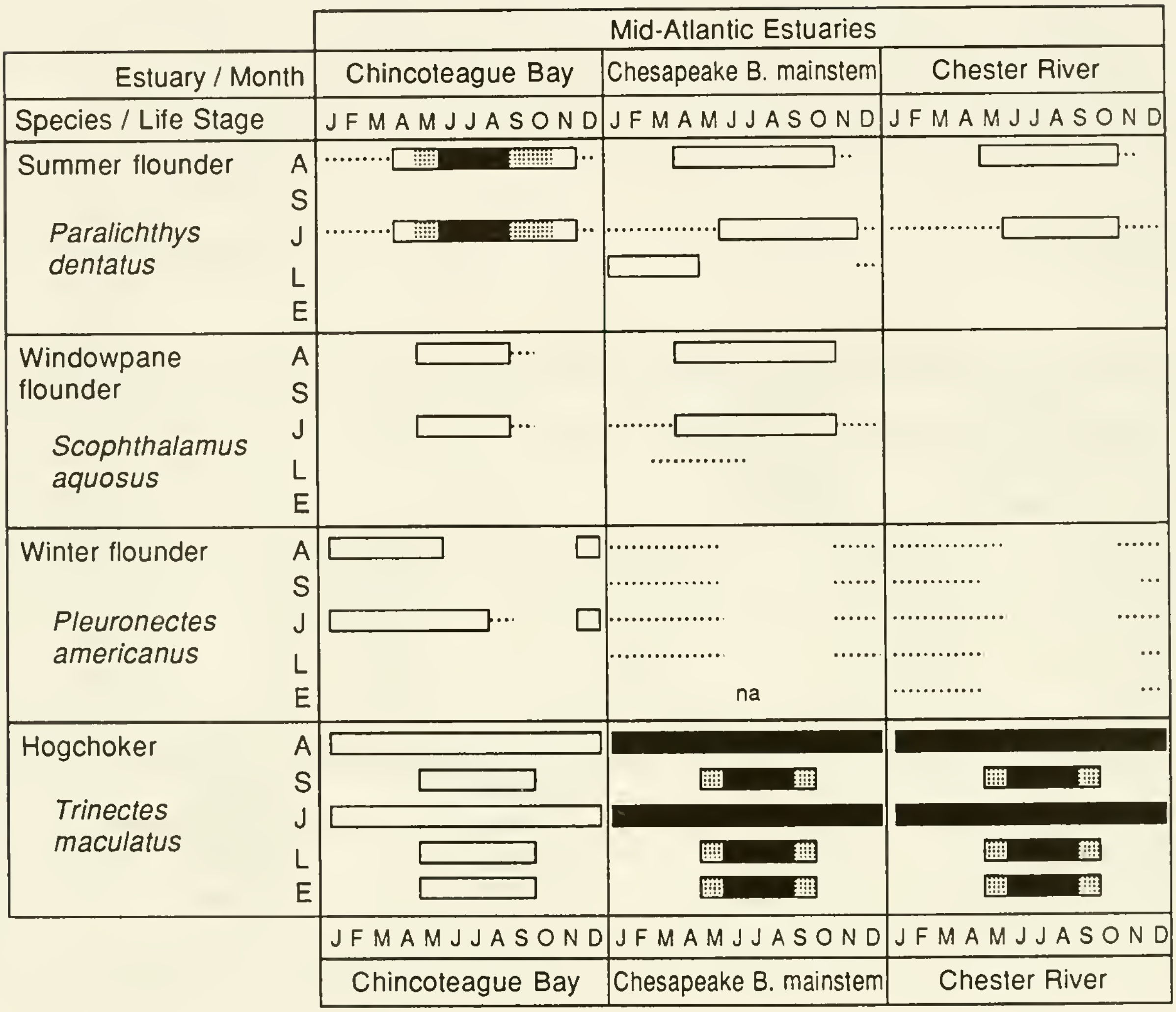
Relative Abundance

■	Highly Abundant
▨	Abundant
□	Common
....	Rare
Blank	Not Present

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs

Table 5, continued. Temporal distribution



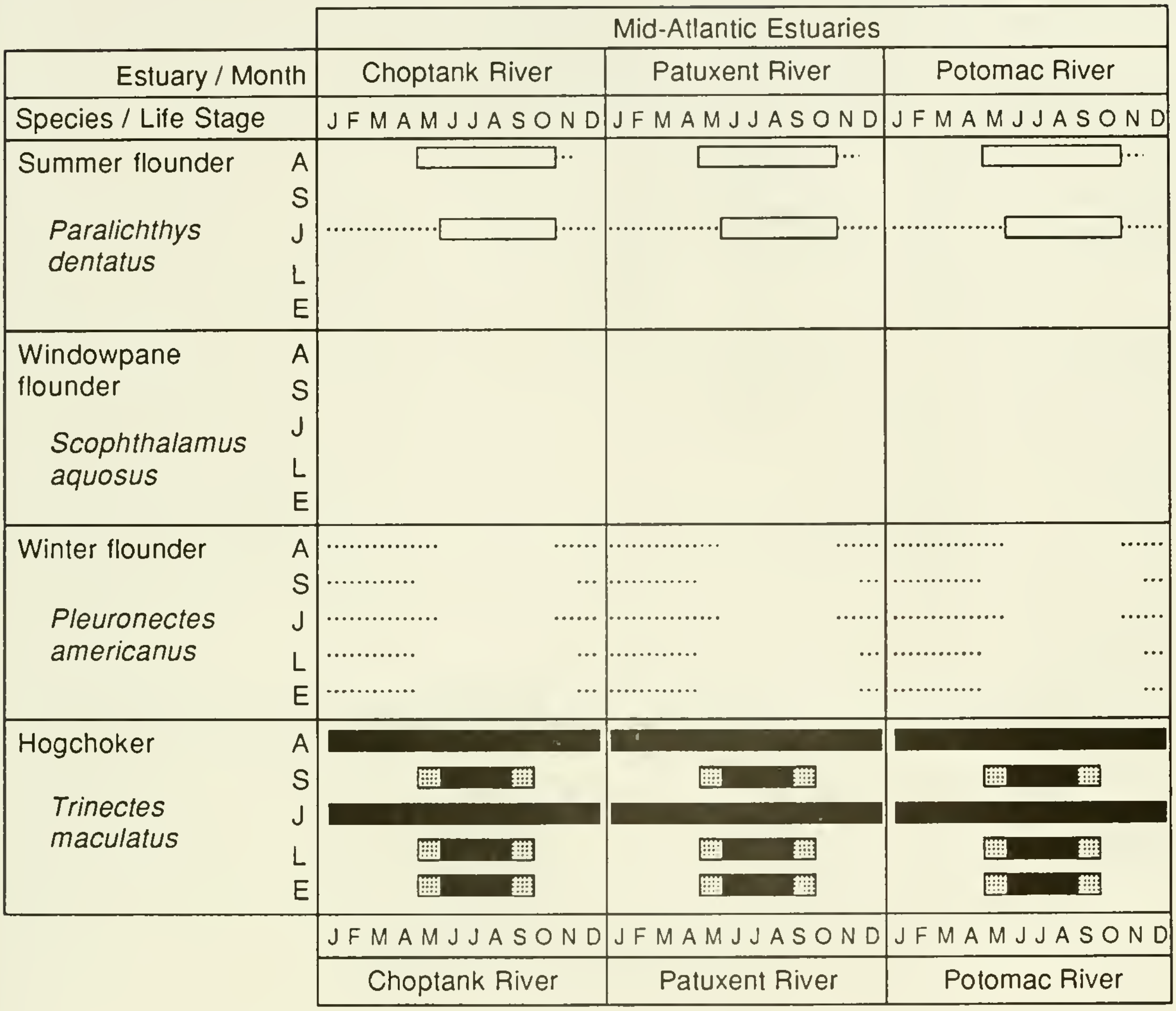
Relative Abundance

■	Highly Abundant
▨	Abundant
▭	Common
········	Rare
Blank	Not Present
na	No Data Available

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs

Table 5, continued. Temporal distribution



Relative Abundance

■	Highly Abundant
▨	Abundant
☐	Common
········	Rare
Blank	Not Present

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs

Table 5, continued. Temporal distribution

		Mid-Atlantic Estuaries																							
Estuary / Month		Tangier/Pocomoke Sd.												Rappahannock River											
Species / Life Stage		J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
Summer flounder	A					□	□	□	□	□	□	⋯					⋯	□	□	□	□	□	⋯		
	S																								
Paralichthys dentatus	J	⋯	⋯	⋯	⋯	⋯	□	□	□	□	□	⋯	⋯	⋯	⋯	⋯	⋯	⋯	⋯	□	□	□	□	□	⋯
	L													⋯	□	□	⋯								
	E																								
Windowpane flounder	A				□	□	□	□	□	□	□														
	S																								
Scophthalamus aquosus	J	⋯	⋯	⋯	□	□	□	□	□	□	□	⋯	⋯												
	L																								
	E																								
Winter flounder	A	⋯	⋯	⋯	⋯	⋯						⋯	⋯	⋯	⋯	⋯	⋯	⋯						⋯	⋯
	S	⋯	⋯	⋯	⋯								⋯	⋯	⋯	⋯	⋯								⋯
Pleuronectes americanus	J	⋯	⋯	⋯	⋯	⋯						⋯	⋯	⋯	⋯	⋯	⋯	⋯						⋯	⋯
	L	⋯	⋯	⋯	⋯								⋯	⋯	⋯	⋯	⋯								⋯
	E	⋯	⋯	⋯	⋯								⋯							na					
Hogchoker	A	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
	S					▨	■	■	■	▨								▨	■	■	■	▨			
Trinectes maculatus	J	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
	L					▨	■	■	■	▨								▨	■	■	■	▨			
	E					▨	■	■	■	▨								▨	■	■	■	▨			
		J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
		Tangier/Pocomoke Sd.												Rappahannock River											

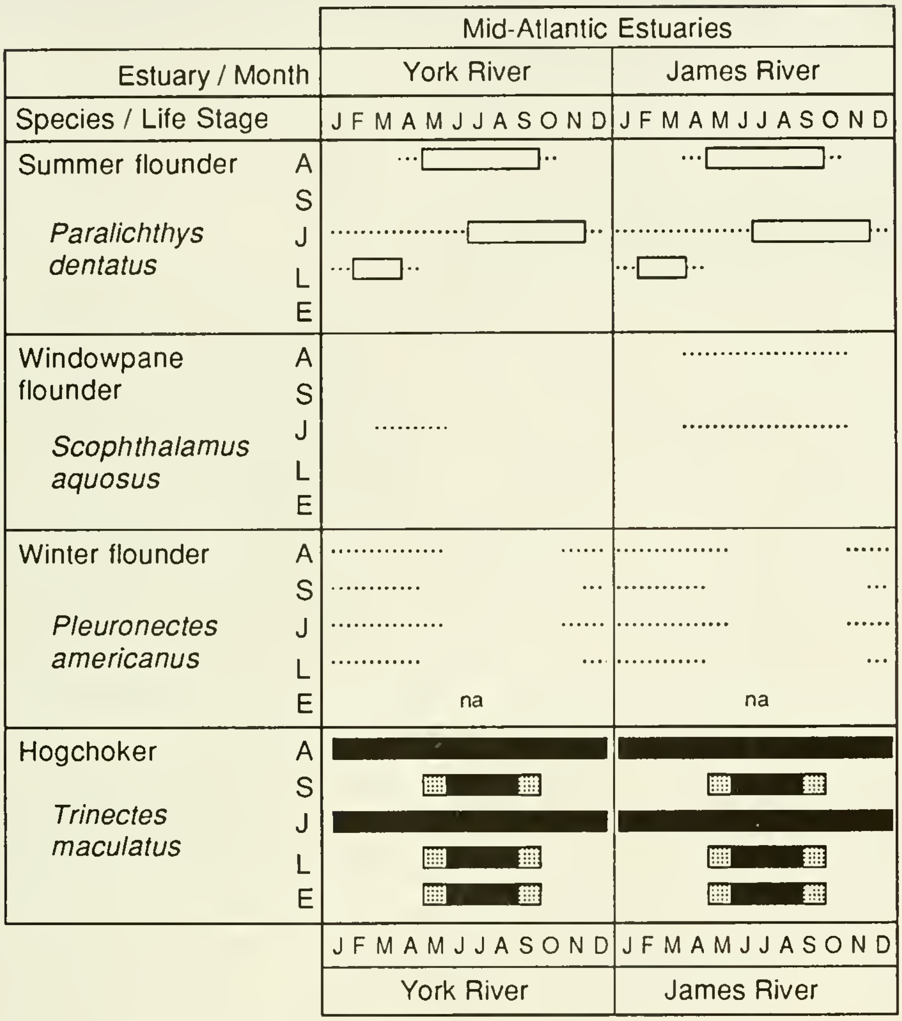
Relative Abundance

■	Highly Abundant
▨	Abundant
□	Common
⋯	Rare
Blank	Not Present
na	No Data Available

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs

Table 5, continued. Temporal distribution



Relative Abundance	
■	Highly Abundant
▨	Abundant
▭	Common
········	Rare
Blank	Not Present
na	No Data Available

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs

Table 6. Data reliability

Index to Table 6. Page location of data reliability table for each species and estuary.

	Waquoit Bay Buzzards Bay Narragansett Bay Long Island Sound Connecticut River Gardiners Bay Great South Bay	Hudson River/Raritan Bay Barnegat Bay New Jersey Inland Bays Delaware Bay Delaware Inland Bays Chincoteague Bay Chesapeake Bay mainstem	Chester River Choptank River Patuxent River Potomac River Tangier/Pocomoke Sound Rappahannock River York River James River
Blue mussel (*Mytilus edulis*) Bay scallop (*Argopecten irradians*) American oyster (*Crassostrea virginica*) Northern quahog (*Mercenaria mercenaria*) Softshell clam (*Mya arenaria*) Brown shrimp (*Penaeus aztecus*)	p. 158	p. 159	p. 160
Daggerblade grass shrimp (*Palaemonetes pugio*) Sevenspine bay shrimp (*Crangon septemspinosa*) American lobster (*Homarus americanus*) Blue crab (*Callinectas sapidus*) Skates (*Raja* species)	p. 161	p. 162	p. 163
Atlantic stingray (*Dasyatis sabina*) Cownose ray (*Rhinoptera bonasus*) Shortnose sturgeon (*Acipenser brevirostrum*) Atlantic sturgeon (*Acipenser oxyrhynchus*) American eel (*Anguilla rostrata*) Blueback herring (*Alosa aestivalis*)	p. 164	p. 165	p. 166
Alewife (*Alosa pseudoharengus*) American shad (*Alosa sapidissima*) Atlantic menhaden (*Brevoortia tyrannus*) Atlantic herring (*Clupea harengus*) Bay anchovy (*Anchoa mitchilli*) Channel catfish (*Ictalurus punctatus*)	p. 167	p. 168	p. 169
Rainbow smelt (*Osmerus mordax*) Atlantic salmon (*Salmo salar*) Atlantic cod (*Gadus morhua*) Haddock (*Melanogrammus aeglefinus*) Atlantic tomcod (*Microgadus tomcod*) Pollock (*Pollachius virens*)	p. 170	p. 171	p. 172
Red hake (*Urophycis chuss*) Oyster toadfish (*Opsanus tau*) Sheepshead minnow (*Cyprinodon variegatus*) Killifishes (*Fundulus* species) Silversides (*Menidia* species) Northern pipefish (*Syngnathus fuscus*)	p. 173	p. 174	p. 175
Northern searobin (*Prionotus carolinus*) White perch (*Morone americana*) Striped bass (*Morone saxatilis*) Black sea bass (*Centropristis striata*) Yellow perch (*Perca flavescens*) Bluefish (*Pomatomus saltatrix*)	p. 176	p. 177	p. 178
Pinfish (*Lagodon rhomboides*) Scup (*Stenotomus chrysops*) Spotted seatrout (*Cynoscion nebulosus*) Weakfish (*Cynoscion regalis*) Spot (*Leiostomus xanthurus*) Northern kingfish (*Menticirrhus saxatilis*)	p. 179	p. 180	p. 181
Atlantic croaker (*Micropogonias undulatus*) Black drum (*Pogonias cromis*) Red drum (*Sciaenops ocellatus*) Mullets (*Mugil* species) Tautog (*Tautoga onitis*) Cunner (*Tautogolabrus adspersus*)	p. 182	p. 183	p. 184
American sand lance (*Ammodytes americanus*) Gobies (*Gobiosoma* species) Atlantic mackerel (*Scomber scombrus*) Butterfish (*Peprilus triacanthus*)	p. 185	p. 186	p. 187
Summer flounder (*Paralichthys dentatus*) Windowpane flounder (*Scophthalmus aquosus*) Winter flounder (*Pleuronectes americanus*) Hogchoker (*Trinectes maculatus*)	p. 188	p. 189	p. 190

Table 6. Data reliability

Species/Life Stage		Mid-Atlantic Estuaries						
		Waquoit Bay	Buzzards Bay	Narragansett Bay	Long Island Sound	Connecticut River	Gardiners Bay	Great South Bay
Blue mussel	A	☐	☐	▣	▣	▣	☐	▣
	S	☐	☐	☐	▣	☐	☐	▣
Mytilus edulis	J	☐	☐	▣	▣	▣	☐	▣
	L	☐	☐	☐	▣	☐	☐	☐
	E	☐	☐	☐	☐	☐	☐	☐
Bay scallop	A	▣	▣	■	☐	☐	▣	▣
	S	■	☐	☐	☐	☐	☐	☐
Argopecten irradians	J	▣	☐	▣	☐	☐	▣	☐
	L	▣	☐	☐	☐	☐	☐	☐
	E	▣	☐	☐	☐	☐	☐	☐
American oyster	A	☐	☐	☐	▣	▣	▣	▣
	S	☐	☐	☐	☐	☐	☐	☐
Crassostrea virginica	J	☐	☐	☐	▣	▣	▣	▣
	L	☐	☐	☐	☐	☐	☐	☐
	E	☐	☐	☐	☐	☐	☐	☐
Northern quahog	A	▣	☐	■	▣	▣	☐	■
	S	☐	☐	■	▣	☐	☐	■
Mercenaria mercenaria	J	▣	☐	■	▣	▣	☐	■
	L	☐	☐	▣	▣	☐	☐	■
	E	☐	☐	▣	▣	☐	☐	■
Softshell clam	A	▣	☐	▣	▣	▣	☐	▣
	S	☐	☐	☐	▣	☐	☐	☐
Mya arenaria	J	▣	☐	▣	▣	▣	☐	▣
	L	☐	☐	☐	☐	☐	☐	☐
	E	☐	☐	☐	☐	☐	☐	☐
Brown shrimp	A	▣	▣	▣	■	▣	☐	▣
	S	▣	▣	■	■	▣	■	■
Penaeus aztecus	J	▣	▣	▣	■	▣	▣	▣
	L	▣	▣	■	■	▣	■	■
	E	▣	▣	■	■	▣	■	■

Waquoit Bay | Buzzards Bay | Narragansett Bay | Long Island Sound | Connecticut River | Gardiners Bay | Great South Bay
Mid-Atlantic Estuaries

Data Reliability

■ Highly Certain
▣ Moderately Certain
☐ Reasonable Inference

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs

Table 6, continued. Data reliability

Species/Life Stage		Mid-Atlantic Estuaries						
		Hudson River / Raritan Bay	Barnegat Bay	New Jersey Inland Bays	Delaware Bay	Delaware Inland Bays	Chincoteague Bay	Chesapeake Bay mainstem
Blue mussel	A	▣	▣	☐	▣	☐	■	■
	S	☐	☐	☐	▣	☐	■	■
Mytilus edulis	J	▣	▣	☐	▣	☐	■	■
	L	☐	☐	☐	▣	☐	■	■
	E	☐	☐	☐	▣	☐	■	■
Bay scallop	A	▣	▣	▣	▣	☐	■	■
	S	▣	▣	▣	▣	■	■	■
Argopecten irradians	J	▣	▣	▣	▣	☐	■	■
	L	▣	▣	▣	▣	■	■	■
	E	▣	▣	▣	▣	■	■	■
American oyster	A	▣	▣	▣	▣	▣	■	■
	S	☐	▣	▣	▣	▣	■	▣
Crassostrea virginica	J	▣	▣	▣	▣	▣	■	■
	L	☐	▣	▣	▣	▣	■	▣
	E	☐	▣	▣	▣	▣	■	▣
Northern quahog	A	■	■	▣	▣	▣	■	■
	S	▣	▣	▣	▣	▣	■	■
Mercenaria mercenaria	J	■	■	▣	▣	▣	■	■
	L	☐	▣	▣	▣	▣	■	■
	E	☐	▣	▣	▣	▣	■	■
Softshell clam	A	▣	▣	▣	▣	▣	■	■
	S	☐	▣	▣	▣	▣	■	■
Mya arenaria	J	▣	▣	▣	▣	▣	■	■
	L	☐	▣	▣	▣	▣	■	■
	E	☐	▣	▣	▣	▣	■	■
Brown shrimp	A	■	▣	▣	▣	▣	■	▣
	S	■	■	■	▣	■	■	■
Penaeus aztecus	J	■	▣	▣	▣	▣	■	▣
	L	■	▣	▣	▣	■	■	▣
	E	■	▣	▣	▣	■	■	■

Hudson River / Raritan Bay | Barnegat Bay | New Jersey Inland Bays | Delaware Bay | Delaware Inland Bays | Chincoteague Bay | Chesapeake Bay mainstem
Mid-Atlantic Estuaries

Data Reliability

■ Highly Certain
▣ Moderately Certain
☐ Reasonable Inference

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs

Table 6, continued. Data reliability

		Mid-Atlantic Estuaries							
Species/Life Stage		Chester River	Choptank River	Patuxent River	Potomac River	Tangier / Pocomoke Sound	Rappa-hannock River	York River	James River
Blue mussel	A	■	■	■	■	■	■	■	■
	S	■	■	■	■	■	■	■	■
Mytilus edulis	J	■	■	■	■	■	■	■	■
	L	■	■	■	■	■	■	■	■
	E	■	■	■	■	■	■	■	■
Bay scallop	A	■	■	■	■	■	■	■	■
	S	■	■	■	■	■	■	■	■
Argopecten irradians	J	■	■	■	■	■	■	■	■
	L	■	■	■	■	■	■	■	■
	E	■	■	■	■	■	■	■	■
American oyster	A	■	■	■	■	■	■	■	■
	S	■	■	■	■	■	▣	▣	▣
Crassostrea virginica	J	■	■	■	■	■	■	■	■
	L	■	■	■	■	■	▣	▣	▣
	E	■	■	■	■	■	▣	▣	▣
Northern quahog	A	■	■	■	■	■	■	■	■
	S	■	■	■	■	■	■	■	■
Mercenaria species	J	■	■	■	■	■	■	■	■
	L	■	■	■	■	■	■	■	■
	E	■	■	■	■	■	■	■	■
Softshell clam	A	▣	▣	▣	▣	▣	■	■	■
	S	▣	▣	▣	▣	▣	■	■	■
Mya arenaria	J	▣	▣	▣	▣	▣	■	■	■
	L	▣	▣	▣	▣	▣	■	■	■
	E	▣	▣	▣	▣	▣	■	■	■
Brown shrimp	A	■	■	■	■	■	▣	▣	▣
	S	■	■	■	■	■	■	■	■
Penaeus aztecus	J	■	■	■	■	■	▣	▣	▣
	L	■	■	■	■	■	▣	▣	▣
	E	■	■	■	■	■	■	■	■
		Chester River	Choptank River	Patuxent River	Potomac River	Tangier / Pocomoke Sound	Rappa-hannock River	York River	James River
		Mid-Atlantic Estuaries							

Data Reliability

■	Highly Certain
▣	Moderately Certain
□	Reasonable Inference

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs

Table 6, continued. Data reliability

Species/Life Stage		Mid-Atlantic Estuaries						
		Waquoit Bay	Buzzards Bay	Narragansett Bay	Long Island Sound	Connecticut River	Gardiners Bay	Great South Bay
Daggerblade grass shrimp *Palaemonetes pugio*	A	□	▣	□	□	□	□	▣
	S	□	□	▣	□	□	□	□
	J	□	□	□	□	□	□	▣
	L	□	□	□	□	□	□	□
	E	□	□	▣	□	□	□	□
Sevenspine bay shrimp *Crangon septemspinosa*	A	▣	▣	□	□	□	□	▣
	S	□	□	□	□	□	□	□
	J	▣	□	□	□	□	□	▣
	L	□	□	□	□	□	□	□
	E	□	□	□	□	□	□	□
American lobster *Homarus americanus*	A	□	□	▣	■	□	▣	▣
	S	□	□	□	▣	□	▣	□
	J	□	□	▣	■	□	▣	▣
	L	□	□	□	▣	□	▣	□
	E	□	□	□	▣	□	▣	□
Blue crab *Callinectes sapidus*	A	■	□	□	□	□	□	▣
	M	□	□	□	□	□	□	▣
	J	■	□	□	□	□	□	▣
	L	□	□	□	□	□	□	▣
	E	□	□	□	□	□	□	▣
Skates *Raja species*	A	▣	▣	▣	▣	□	□	□
	M	□	□	□	▣	□	□	□
	J	▣	▣	▣	▣	□	□	□
	E	□	□	□	▣	□	□	□
		Waquoit Bay	Buzzards Bay	Narragansett Bay	Long Island Sound	Connecticut River	Gardiners Bay	Great South Bay
		Mid-Atlantic Estuaries						

Data Reliability

■	Highly Certain
▣	Moderately Certain
□	Reasonable Inference

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs
M - Mating

Table 6, continued. Data reliability

Species/Life Stage		Mid-Atlantic Estuaries						
		Hudson River / Raritan Bay	Barnegat Bay	New Jersey Inland Bays	Delaware Bay	Delaware Inland Bays	Chincoteague Bay	Chesapeake Bay mainstem
Daggerblade grass shrimp *Palaemonetes pugio*	A	▣	▣	▣	□	■	■	▣
	S	□	▣	▣	□	▣	■	▣
	J	▣	▣	▣	□	▣	■	▣
	L	□	▣	▣	□	▣	■	▣
	E	□	▣	▣	□	▣	■	▣
Sevenspine bay shrimp *Crangon septemspinosa*	A	■	▣	▣	▣	▣	■	■
	S	□	▣	□	▣	▣	■	▣
	J	□	▣	□	▣	▣	■	■
	L	□	▣	□	▣	□	■	▣
	E	□	▣	□	▣	▣	■	▣
American lobster *Homarus americanus*	A	□	▣	▣	▣	▣	■	▣
	S	□	■	■	▣	□	■	■
	J	□	▣	▣	▣	▣	■	▣
	L	□	■	■	▣	□	■	■
	E	□	■	■	▣	□	■	■
Blue crab *Callinectes sapidus*	A	□	▣	▣	□	□	■	▣
	M	□	▣	▣	□	□	■	■
	J	□	▣	▣	□	□	■	▣
	L	□	▣	▣	▣	□	■	▣
	E	□	▣	▣	□	□	■	▣
Skates *Raja species*	A	▣	□	□	■	□	▣	▣
	M	▣	▣	▣	■	▣	□	■
	J	▣	▣	▣	■	▣	▣	▣
	E	▣	▣	▣	■	▣	□	▣

Hudson River / Raritan Bay | Barnegat Bay | New Jersey Inland Bays | Delaware Bay | Delaware Inland Bays | Chincoteague Bay | Chesapeake Bay mainstem

Mid-Atlantic Estuaries

Data Reliability

■	Highly Certain
▣	Moderately Certain
□	Reasonable Inference

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs
M - Mating

Table 6, continued. Data reliability

Species/Life Stage		Mid-Atlantic Estuaries							
		Chester River	Choptank River	Patuxent River	Potomac River	Tangier / Pocomoke Sound	Rappa-hannock River	York River	James River
Daggerblade grass shrimp *Palaemonetes pugio*	A	▣	▣	▣	▣	▣	▣	■	■
	S	▣	▣	▣	▣	▣	▣	▣	▣
	J	▣	▣	▣	▣	▣	▣	■	■
	L	▣	▣	▣	▣	▣	▣	▣	▣
	E	▣	▣	▣	▣	▣	▣	▣	▣
Sevenspine bay shrimp *Crangon septemspinosa*	A	■	■	■	■	■	■	■	■
	S	▣	▣	▣	▣	▣	▣	▣	▣
	J	■	■	■	■	■	■	■	■
	L	▣	▣	▣	▣	▣	▣	▣	▣
	E	▣	▣	▣	▣	▣	▣	▣	▣
American lobster *Homarus americanus*	A	■	■	■	■	■	■	■	■
	S	■	■	■	■	■	■	■	■
	J	■	■	■	■	■	■	■	■
	L	■	■	■	■	■	■	■	■
	E	■	■	■	■	■	■	■	■
Blue crab *Callinectes sapidus*	A	▣	▣	▣	▣	▣	▣	▣	▣
	M	▣	▣	▣	▣	▣	▣	▣	▣
	J	▣	▣	▣	▣	▣	▣	▣	▣
	L	■	■	■	■	■	▣	▣	▣
	E	■	■	■	■	■	▣	▣	▣
Skates *Raja species*	A	▣	▣	▣	▣	▣	▣	▣	▣
	M	▣	▣	▣	▣	▣	■	■	■
	J	▣	▣	▣	▣	▣	▣	▣	▣
	E	▣	▣	▣	▣	▣	■	■	■
		Chester River	Choptank River	Patuxent River	Potomac River	Tangier / Pocomoke Sound	Rappa-hannock River	York River	James River
		Mid-Atlantic Estuaries							

Data Reliability

■ Highly Certain

▣ Moderately Certain

☐ Reasonable Inference

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs
M - Mating

Table 6, continued. Data reliability

Species/Life Stage		Mid-Atlantic Estuaries						
		Waquoit Bay	Buzzards Bay	Narragansett Bay	Long Island Sound	Connecticut River	Gardiners Bay	Great South Bay
Atlantic stingray *Dasyatis sabina*	A	■	□	▣	▣	■	▣	□
	M	■	▣	▣	▣	■	▣	▣
	J	■	□	▣	▣	■	▣	▣
	P	■	□	▣	▣	■	▣	▣
Cownose ray *Rhinoptera bonansus*	A	■	□	□	□	▣	□	□
	M	■	▣	▣	□	▣	□	□
	J	■	□	▣	□	▣	□	□
	P	■	□	▣	□	■	□	□
Shortnose sturgeon *Acipenser brevirostrum*	A	■	□	□	▣	□	□	□
	S	■	□	□	▣	▣	▣	▣
	J	■	□	□	▣	□	□	□
	L	■	□	□	▣	□	▣	▣
	E	■	□	□	▣	□	▣	▣
Atlantic sturgeon *Acipenser oxyrhynchus*	A	▣	□	□	□	□	□	□
	S	■	□	□	▣	□	□	□
	J	▣	□	□	□	□	□	□
	L	■	□	□	▣	□	□	□
	E	■	□	□	▣	□	□	□
American eel *Anguilla rostrata*	A	▣	□	▣	□	□	□	□
	S	■	■	■	■	■	■	■
	J	▣	▣	□	□	□	□	□
	L	□	□	▣	□	□	□	□
	E	■	■	■	■	■	■	■
Blueback herring *Alosa aestivalis*	A	□	□	□	□	□	□	□
	S	□	□	□	□	□	□	■
	J	□	□	□	□	□	□	□
	L	□	□	□	□	□	□	■
	E	□	□	□	□	□	□	■

Waquoit Bay | Buzzards Bay | Narragansett Bay | Long Island Sound | Connecticut River | Gardiners Bay | Great South Bay
Mid-Atlantic Estuaries

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs
M - Mating
P - Parturition

Data Reliability

■ Highly Certain
▣ Moderately Certain
□ Reasonable Inference

Table 6, continued. Data reliability

Species/Life Stage		Mid-Atlantic Estuaries						
		Hudson River / Raritan Bay	Barnegat Bay	New Jersey Inland Bays	Delaware Bay	Delaware Inland Bays	Chincoteague Bay	Chesapeake Bay mainstem
Atlantic stingray	A	■	■	■	▣	▣	■	▣
	M	■	■	■	▣	▣	■	■
Dasyatis sabina	J	■	■	■	▣	▣	■	▣
	P	■	■	■	▣	▣	■	■
Cownose ray	A	▣	▣	▣	▣	▣	■	▣
	M	□	▣	▣	▣	▣	□	□
Rhinoptera bonansus	J	□	▣	▣	▣	▣	■	▣
	P	□	▣	▣	▣	▣	□	■
Shortnose sturgeon	A	□	■	■	▣	■	■	▣
	S	▣	■	■	▣	■	■	▣
Acipenser brevirostrum	J	□	■	■	▣	■	■	▣
	L	▣	■	■	▣	■	■	▣
	E	▣	■	■	▣	■	■	▣
Atlantic sturgeon	A	▣	■	■	▣	□	■	▣
Acipenser oxyrhynchus	S	▣	■	■	▣	□	■	▣
	J	▣	■	■	▣	□	■	□
	L	▣	■	■	▣	□	■	▣
	E	▣	■	■	▣	□	■	▣
American eel	A	□	▣	▣	■	□	▣	□
Anguilla rostrata	S	■	■	■	■	■	■	■
	J	□	▣	▣	■	▣	▣	▣
	L	□	▣	▣	■	▣	■	▣
	E	■	■	■	■	■	■	■
Blueback herring	A	▣	▣	▣	▣	▣	■	▣
Alosa aestivalis	S	▣	▣	▣	▣	▣	■	▣
	J	▣	▣	▣	▣	■	■	▣
	L	□	▣	▣	▣	▣	■	▣
	E	□	▣	▣	▣	▣	■	▣

Hudson River / Raritan Bay | Barnegat Bay | New Jersey Inland Bays | Delaware Bay | Delaware Inland Bays | Chincoteague Bay | Chesapeake Bay mainstem
Mid-Atlantic Estuaries

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs
M - Mating
P - Parturition

Data Reliability

■ Highly Certain
▣ Moderately Certain
□ Reasonable Inference

Table 6, continued. Data reliability

Species/Life Stage		Mid-Atlantic Estuaries							
		Chester River	Choptank River	Patuxent River	Potomac River	Tangier / Pocomoke Sound	Rappahannock River	York River	James River
Atlantic stingray *Dasyatis sabina*	A	■	■	■	■	■	▣	▣	▣
	M	■	■	■	■	■	■	■	■
	J	■	■	■	■	■	▣	▣	▣
	P	■	■	■	■	■	■	■	■
Cownose ray *Rhinoptera bonansus*	A	■	■	■	■	■	▣	▣	▣
	M	□	□	□	□	□	□	□	□
	J	■	■	■	■	■	▣	▣	▣
	P	■	■	■	■	■	■	■	■
Shortnose sturgeon *Acipenser brevirostrum*	A	▣	▣	▣	▣	▣	▣	▣	▣
	S	▣	▣	▣	▣	■	▣	▣	▣
	J	▣	▣	▣	▣	▣	▣	▣	▣
	L	▣	▣	▣	▣	▣	▣	▣	▣
	E	▣	▣	▣	▣	▣	▣	▣	▣
Atlantic sturgeon *Acipenser oxyrhynchus*	A	▣	▣	▣	□	□	▣	▣	▣
	S	▣	▣	▣	□	■	▣	▣	▣
	J	▣	▣	▣	□	□	▣	▣	▣
	L	▣	▣	▣	□	■	▣	▣	▣
	E	▣	▣	▣	□	■	▣	▣	▣
American eel *Anguilla rostrata*	A	■	■	■	■	■	▣	▣	□
	S	■	■	■	■	■	■	■	■
	J	■	■	■	■	■	▣	▣	▣
	L	■	■	■	■	■	▣	▣	▣
	E	■	■	■	■	■	■	■	■
Blueback herring *Alosa aestivalis*	A	▣	▣	▣	▣	▣	■	■	■
	S	▣	▣	▣	▣	▣	▣	▣	▣
	J	▣	▣	▣	▣	▣	■	■	■
	L	▣	▣	▣	▣	▣	▣	▣	▣
	E	▣	▣	▣	▣	▣	▣	▣	▣
		Chester River	Choptank River	Patuxent River	Potomac River	Tangier / Pocomoke Sound	Rappahannock River	York River	James River
		Mid-Atlantic Estuaries							

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs
M - Mating
P - Parturition

Data Reliability

■	Highly Certain
▣	Moderately Certain
□	Reasonable Inference

Table 6, continued. Data reliability

Species/Life Stage		Mid-Atlantic Estuaries						
		Waquoit Bay	Buzzards Bay	Narragansett Bay	Long Island Sound	Connecticut River	Gardiners Bay	Great South Bay
Alewife *Alosa pseudoharengus*	A	□	□	□	□	□	□	□
	S	□	□	▣	▣	□	□	▣
	J	□	□	□	□	□	□	□
	L	□	□	▣	▣	□	□	▣
	E	□	□	□	▣	□	□	▣
American shad *Alosa sapidissima*	A	□	□	□	□	▣	□	□
	S	■	■	□	□	▣	□	▣
	J	□	□	□	□	▣	□	□
	L	■	▣	□	□	▣	□	▣
	E	■	▣	□	□	▣	□	▣
Atlantic menhaden *Brevoortia tyrannus*	A	□	□	□	□	□	□	□
	S	□	▣	▣	■	▣	▣	□
	J	□	□	□	□	□	□	□
	L	□	□	□	□	□	□	▣
	E	□	□	▣	▣	▣	▣	▣
Atlantic herring *Clupea harengus*	A	□	□	□	□	□	□	□
	S	■	■	▣	■	□	▣	▣
	J	□	□	□	□	□	□	□
	L	□	□	□	▣	□	▣	▣
	E	■	▣	▣	■	□	▣	▣
Bay anchovy *Anchoa mitchilli*	A	▣	□	□	□	□	□	□
	S	□	□	□	□	□	▣	■
	J	▣	□	□	□	□	□	□
	L	□	□	□	□	□	▣	■
	E	□	□	□	□	□	▣	■
Channel catfish *Ictalurus punctatus*	A	■	▣	□	□	□	□	■
	S	■	▣	□	□	□	▣	■
	J	■	▣	□	□	□	□	■
	L	■	▣	□	□	□	▣	■
	E	■	▣	□	□	□	▣	■

Waquoit Bay | Buzzards Bay | Narragansett Bay | Long Island Sound | Connecticut River | Gardiners Bay | Great South Bay

Mid-Atlantic Estuaries

Data Reliability

■ Highly Certain

▣ Moderately Certain

□ Reasonable Inference

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs

Table 6, continued. Data reliability

Species/Life Stage		Mid-Atlantic Estuaries						
		Hudson River / Raritan Bay	Barnegat Bay	New Jersey Inland Bays	Delaware Bay	Delaware Inland Bays	Chincoteague Bay	Chesapeake Bay mainstem
Alewife *Alosa pseudoharengus*	A	□	▣	▣	▣	▣	■	▣
	S	▣	▣	▣	▣	▣	■	▣
	J	□	▣	▣	▣	■	□	▣
	L	▣	▣	▣	▣	▣	■	▣
	E	▣	▣	▣	▣	▣	■	▣
American shad *Alosa sapidissima*	A	□	▣	▣	■	▣	■	▣
	S	■	■	■	■	▣	■	▣
	J	□	▣	▣	▣	▣	■	▣
	L	▣	■	■	▣	▣	■	▣
	E	▣	■	■	▣	▣	■	▣
Atlantic menhaden *Brevoortia tyrannus*	A	▣	▣	▣	■	▣	■	▣
	S	▣	▣	▣	▣	□	■	□
	J	▣	▣	▣	■	▣	■	▣
	L	▣	▣	▣	■	▣	□	□
	E	▣	▣	▣	■	□	■	▣
Atlantic herring *Clupea harengus*	A	▣	▣	▣	■	□	■	■
	S	□	■	■	■	■	■	■
	J	▣	▣	▣	▣	□	▣	▣
	L	□	▣	▣	▣	▣	■	■
	E	□	■	■	▣	■	■	■
Bay anchovy *Anchoa mitchilli*	A	▣	□	□	▣	■	■	■
	S	□	▣	▣	▣	■	▣	■
	J	▣	□	□	▣	■	■	▣
	L	□	□	□	▣	■	▣	■
	E	□	▣	▣	▣	■	▣	■
Channel catfish *Ictalurus punctatus*	A	□	▣	▣	■	■	▣	■
	S	▣	▣	▣	▣	■	▣	■
	J	□	▣	▣	■	■	▣	■
	L	▣	▣	▣	▣	▣	▣	■
	E	▣	▣	▣	▣	■	▣	■

Hudson River / Raritan Bay | Barnegat Bay | New Jersey Inland Bays | Delaware Bay | Delaware Inland Bays | Chincoteague Bay | Chesapeake Bay mainstem
Mid-Atlantic Estuaries

Data Reliability

■ Highly Certain

▣ Moderately Certain

□ Reasonable Inference

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs

Table 6, continued. Data reliability

Species/Life Stage		Mid-Atlantic Estuaries							
		Chester River	Choptank River	Patuxent River	Potomac River	Tangier / Pocomoke Sound	Rappahannock River	York River	James River
Alewife	A	▣	▣	▣	▣	▣	■	■	■
	S	▣	▣	▣	▣	■	▣	▣	□
Alosa pseudoharengus	J	▣	▣	▣	▣	▣	■	■	■
	L	▣	▣	▣	▣	■	▣	▣	□
	E	▣	▣	▣	▣	■	▣	▣	□
American shad	A	▣	▣	▣	▣	▣	■	■	■
	S	▣	▣	▣	▣	■	▣	▣	▣
Alosa sapidissima	J	▣	▣	▣	▣	▣	■	■	■
	L	▣	▣	▣	▣	■	▣	▣	▣
	E	▣	▣	▣	▣	■	▣	▣	▣
Atlantic menhaden	A	▣	▣	▣	▣	▣	▣	□	▣
	S	▣	▣	▣	▣	□	□	□	□
Brevoortia tyrannus	J	▣	▣	▣	▣	▣	▣	▣	▣
	L	▣	□	□	□	□	□	□	□
	E	▣	▣	▣	▣	□	□	□	□
Atlantic herring	A	■	■	■	■	■	▣	▣	▣
	S	■	■	■	■	■	■	■	■
Clupea harengus	J	■	■	■	■	■	▣	▣	▣
	L	■	■	■	■	■	■	■	■
	E	■	■	■	■	■	■	■	■
Bay anchovy	A	▣	▣	▣	▣	■	▣	▣	▣
	S	▣	▣	▣	▣	▣	▣	▣	▣
Anchoa mitchilli	J	▣	▣	▣	▣	▣	▣	▣	▣
	L	▣	▣	▣	▣	▣	▣	▣	▣
	E	▣	▣	▣	▣	▣	▣	▣	▣
Channel catfish	A	■	■	■	■	▣	■	■	■
	S	■	■	■	■	■	■	■	■
Ictalurus punctatus	J	■	■	■	■	▣	■	■	■
	L	■	■	■	■	■	■	■	■
	E	■	■	■	■	■	■	■	■

Chester River | Choptank River | Patuxent River | Potomac River | Tangier / Pocomoke Sound | Rappahannock River | York River | James River

Mid-Atlantic Estuaries

Data Reliability

■ Highly Certain

▣ Moderately Certain

□ Reasonable Inference

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs

Table 6, continued. Data reliability

Species/Life Stage		Mid-Atlantic Estuaries						
		Waquoit Bay	Buzzards Bay	Narragansett Bay	Long Island Sound	Connecticut River	Gardiners Bay	Great South Bay
Rainbow smelt	A	☐	☐	☐	☐	☐	☐	■
	S	☐	▣	☐	☐	☐	☐	■
Osmerus mordax	J	☐	▣	☐	☐	☐	☐	■
	L	☐	☐	☐	☐	☐	☐	■
	E	☐	▣	☐	☐	☐	☐	■
Atlantic salmon	A	■	▣	▣	☐	☐	☐	■
	S	■	▣	■	☐	☐	■	■
Salmo salar	J	■	▣	■	☐	☐	☐	■
	L	■	▣	■	☐	☐	■	■
	E	■	▣	■	☐	☐	■	■
Atlantic cod	A	▣	☐	☐	☐	■	☐	☐
	S	▣	▣	▣	☐	■	☐	☐
Gadus morhua	J	☐	☐	☐	☐	■	☐	☐
	L	☐	▣	▣	☐	■	☐	☐
	E	☐	▣	▣	☐	■	☐	☐
Haddock	A	■	▣	▣	☐	■	☐	▣
	S	■	▣	▣	■	■	▣	■
Melanogrammus aeglefinus	J	▣	▣	▣	☐	■	☐	▣
	L	▣	▣	▣	■	■	▣	■
	E	▣	▣	▣	■	■	▣	■
Atlantic tomcod	A	▣	▣	☐	☐	☐	☐	☐
	S	☐	▣	☐	☐	☐	☐	☐
Microgadus tomcod	J	▣	▣	☐	☐	☐	☐	☐
	L	☐	▣	☐	☐	☐	☐	☐
	E	☐	▣	☐	☐	☐	☐	☐
Pollock	A	☐	☐	▣	☐	■	☐	☐
	S	▣	☐	▣	▣	■	▣	▣
Pollachius virens	J	▣	▣	▣	☐	■	☐	▣
	L	☐	☐	▣	▣	■	☐	☐
	E	☐	☐	▣	■	■	▣	▣
		Waquoit Bay	Buzzards Bay	Narragansett Bay	Long Island Sound	Connecticut River	Gardiners Bay	Great South Bay
		Mid-Atlantic Estuaries						

Data Reliability

■ Highly Certain

▣ Moderately Certain

☐ Reasonable Inference

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs

Table 6, continued. Data reliability

Species/Life Stage		Mid-Atlantic Estuaries						
		Hudson River / Raritan Bay	Barnegat Bay	New Jersey Inland Bays	Delaware Bay	Delaware Inland Bays	Chincoteague Bay	Chesapeake Bay mainstem
Rainbow smelt	A	□	■	■	■	▣	■	■
	S	□	■	■	■	■	■	■
Osmerus mordax	J	□	■	■	■	▣	■	■
	L	▣	■	■	■	■	■	■
	E	□	■	■	■	■	■	■
Atlantic salmon	A	▣	■	■	■	■	■	■
	S	■	■	■	■	■	■	■
Salmo salar	J	▣	■	■	■	■	■	■
	L	■	■	■	■	■	■	■
	E	■	■	■	■	■	■	■
Atlantic cod	A	□	■	■	▣	▣	■	■
	S	□	■	■	▣	■	■	■
Gadus morhua	J	□	■	■	▣	▣	■	■
	L	□	■	■	▣	■	■	■
	E	□	■	■	▣	■	■	■
Haddock	A	□	■	■	▣	▣	■	■
	S	▣	■	■	▣	■	■	■
Melanogrammus aeglefinus	J	□	■	■	▣	▣	■	■
	L	▣	■	■	▣	■	■	■
	E	▣	■	■	▣	■	■	■
Atlantic tomcod	A	▣	■	■	▣	▣	■	▣
	S	□	■	■	■	■	■	■
Microgadus tomcod	J	▣	■	■	▣	▣	■	▣
	L	□	■	■	■	■	■	■
	E	□	■	■	■	■	■	■
Pollock	A	□	▣	■	▣	▣	■	■
	S	▣	■	■	▣	■	■	■
Pollachius virens	J	□	▣	▣	▣	▣	■	■
	L	▣	▣	▣	▣	■	■	■
	E	▣	■	■	▣	■	■	■

Hudson River / Raritan Bay | Barnegat Bay | New Jersey Inland Bays | Delaware Bay | Delaware Inland Bays | Chincoteague Bay | Chesapeake Bay mainstem
Mid-Atlantic Estuaries

Data Reliability	
■	Highly Certain
▣	Moderately Certain
□	Reasonable Inference

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs

Table 6, continued. Data reliability

Species/Life Stage		Mid-Atlantic Estuaries							
		Chester River	Choptank River	Patuxent River	Potomac River	Tangier / Pocomoke Sound	Rappa-hannock River	York River	James River
Rainbow smelt *Osmerus mordax*	A	■	■	■	■	■	■	■	■
	S	■	■	■	■	■	■	■	■
	J	■	■	■	■	■	■	■	■
	L	■	■	■	■	■	■	■	■
	E	■	■	■	■	■	■	■	■
Atlantic salmon *Salmo salar*	A	■	■	■	■	■	■	■	■
	S	■	■	■	■	■	■	■	■
	J	■	■	■	■	■	■	■	■
	L	■	■	■	■	■	■	■	■
	E	■	■	■	■	■	■	■	■
Atlantic cod *Gadus morhua*	A	■	■	■	■	■	■	■	■
	S	■	■	■	■	■	■	■	■
	J	■	■	■	■	■	■	■	■
	L	■	■	■	■	■	■	■	■
	E	■	■	■	■	■	■	■	■
Haddock *Melanogrammus aeglefinus*	A	■	■	■	■	■	■	■	■
	S	■	■	■	■	■	■	■	■
	J	■	■	■	■	■	■	■	■
	L	■	■	■	■	■	■	■	■
	E	■	■	■	■	■	■	■	■
Atlantic tomcod *Microgadus tomcod*	A	■	■	■	■	■	■	■	■
	S	■	■	■	■	■	■	■	■
	J	■	■	■	■	■	■	■	■
	L	■	■	■	■	■	■	■	■
	E	■	■	■	■	■	■	■	■
Pollock *Pollachius virens*	A	■	■	■	■	■	■	■	■
	S	■	■	■	■	■	■	■	■
	J	■	■	■	■	■	■	■	■
	L	■	■	■	■	■	■	■	■
	E	■	■	■	■	■	■	■	■
		Chester River	Choptank River	Patuxent River	Potomac River	Tangier / Pocomoke Sound	Rappa-hannock River	York River	James River
		Mid-Atlantic Estuaries							

Data Reliability

■ Highly Certain

▣ Moderately Certain

☐ Reasonable Inference

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs

Table 6, continued. Data reliability

Species/Life Stage		Mid-Atlantic Estuaries						
		Waquoit Bay	Buzzards Bay	Narragansett Bay	Long Island Sound	Connecticut River	Gardiners Bay	Great South Bay
Red hake	A	☐	☐	▣	☐	☐	☐	☐
	S	☐	☐	☐	▣	▣	▣	▣
Urophycis chuss	J	☐	☐	☐	☐	☐	☐	☐
	L	☐	☐	☐	▣	▣	▣	▣
	E	☐	☐	☐	▣	▣	▣	■
Oyster toadfish	A	▣	☐	▣	☐	☐	☐	▣
	S	☐	☐	☐	☐	☐	☐	☐
Opsanus tau	J	▣	☐	▣	☐	☐	☐	▣
	L	☐	☐	☐	☐	☐	☐	☐
	E	☐	☐	☐	☐	☐	☐	☐
Sheepshead minnow	A	■	▣	☐	☐	☐	☐	■
	S	☐	☐	☐	☐	☐	☐	☐
Cyprinodon variegatus	J	■	▣	☐	☐	☐	☐	■
	L	☐	☐	☐	☐	☐	☐	☐
	E	☐	☐	☐	☐	☐	☐	☐
Killifishes	A	■	▣	▣	☐	☐	☐	■
	S	▣	☐	☐	☐	☐	☐	☐
Fundulus species	J	■	▣	▣	☐	☐	☐	■
	L	▣	☐	☐	☐	☐	☐	▣
	E	▣	☐	☐	☐	☐	☐	▣
Silversides	A	▣	▣	☐	☐	☐	▣	■
	S	☐	☐	☐	☐	☐	▣	☐
Menidia species	J	▣	▣	☐	☐	☐	▣	■
	L	☐	☐	☐	☐	☐	▣	■
	E	☐	☐	☐	☐	☐	▣	▣
Northern pipefish	A	■	▣	▣	▣	☐	☐	▣
	M	☐	☐	☐	☐	☐	☐	☐
Syngnathus fuscus	J	■	▣	▣	▣	☐	☐	☐
	L	☐	☐	▣	☐	☐	▣	▣

Waquoit Bay | Buzzards Bay | Narragansett Bay | Long Island Sound | Connecticut River | Gardiners Bay | Great South Bay

Mid-Atlantic Estuaries

Data Reliability

■ Highly Certain

▣ Moderately Certain

☐ Reasonable Inference

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs
M - Mating

Table 6, continued. Data reliability

Species/Life Stage		Mid-Atlantic Estuaries						
		Hudson River / Raritan Bay	Barnegat Bay	New Jersey Inland Bays	Delaware Bay	Delaware Inland Bays	Chincoteague Bay	Chesapeake Bay mainstem
Red hake	A	□	▣	▣	■	▣	■	▣
	S	▣	■	■	■	■	■	■
Urophycis chuss	J	□	□	□	■	▣	▣	▣
	L	□	▣	▣	■	■	■	■
	E	□	■	■	■	■	■	■
Oyster toadfish	A	▣	▣	▣	▣	□	■	■
	S	▣	▣	▣	▣	□	□	▣
Opsanus tau	J	▣	▣	▣	▣	□	■	▣
	L	▣	▣	▣	▣	□	□	▣
	E	▣	▣	▣	▣	□	□	▣
Sheepshead minnow	A	□	▣	▣	■	■	■	▣
	S	□	▣	▣	■	■	□	▣
Cyprinodon variegatus	J	□	▣	▣	■	■	■	▣
	L	□	▣	▣	■	■	□	▣
	E	□	▣	▣	■	■	□	▣
Killifishes	A	▣	▣	▣	■	▣	■	■
	S	□	▣	▣	■	▣	■	▣
Fundulus species	J	▣	▣	▣	■	▣	■	■
	L	□	▣	▣	■	▣	■	▣
	E	□	▣	▣	■	▣	■	▣
Silversides	A	▣	▣	▣	■	■	■	■
	S	▣	■	■	▣	▣	▣	▣
Menidia species	J	▣	▣	▣	■	■	■	■
	L	▣	■	▣	▣	▣	▣	▣
	E	▣	■	▣	▣	▣	▣	▣
Northern pipefish	A	▣	■	■	▣	▣	■	■
	M	□	■	■	▣	▣	□	▣
Syngnathus fuscus	J	▣	■	■	▣	▣	■	■
	L	▣	■	■	▣	▣	□	▣
		Hudson River / Raritan Bay	Barnegat Bay	New Jersey Inland Bays	Delaware Bay	Delaware Inland Bays	Chincoteague Bay	Chesapeake Bay mainstem
		Mid-Atlantic Estuaries						

Data Reliability

■ Highly Certain

▣ Moderately Certain

□ Reasonable Inference

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs
M - Mating

Table 6, continued. Data reliability

		Mid-Atlantic Estuaries							
Species/Life Stage		Chester River	Choptank River	Patuxent River	Potomac River	Tangier / Pocomoke Sound	Rappa-hannock River	York River	James River
Red hake *Urophycis chuss*	A	■	■	■	■	■	▣	▣	▣
	S	■	■	■	■	■	■	■	■
	J	■	■	■	■	■	▣	▣	▣
	L	■	■	■	■	■	■	■	■
	E	■	■	■	■	■	■	■	■
Oyster toadfish *Opsanus tau*	A	■	■	■	■	■	■	■	■
	S	■	■	■	■	▣	▣	▣	▣
	J	■	■	■	■	■	■	■	■
	L	■	■	■	■	▣	▣	▣	▣
	E	■	■	■	■	▣	▣	▣	▣
Sheepshead minnow *Cyprinodon variegatus*	A	▣	▣	▣	▣	▣	▣	▣	▣
	S	▣	▣	▣	▣	▣	▣	▣	▣
	J	▣	▣	▣	▣	▣	▣	▣	▣
	L	▣	▣	▣	▣	▣	▣	▣	▣
	E	▣	▣	▣	▣	▣	▣	▣	▣
Killifishes *Fundulus* species	A	■	■	■	■	■	■	■	■
	S	▣	▣	▣	▣	▣	▣	▣	▣
	J	■	■	■	■	■	■	■	■
	L	▣	▣	▣	▣	▣	▣	▣	▣
	E	▣	▣	▣	▣	▣	▣	▣	▣
Silversides *Menidia* species	A	■	■	■	■	■	▣	■	■
	S	▣	▣	▣	▣	▣	▣	▣	▣
	J	■	■	■	■	■	▣	■	■
	L	▣	▣	▣	▣	▣	▣	▣	▣
	E	▣	▣	▣	▣	▣	▣	▣	▣
Northern pipefish *Syngnathus fuscus*	A	▣	▣	▣	▣	▣	■	■	■
	M	▣	▣	▣	▣	▣	▣	▣	▣
	J	▣	▣	▣	▣	▣	■	■	■
	L	▣	▣	▣	▣	▣	▣	▣	▣
		Chester River	Choptank River	Patuxent River	Potomac River	Tangier / Pocomoke Sound	Rappa-hannock River	York River	James River
		Mid-Atlantic Estuaries							

Data Reliability

■	Highly Certain
▣	Moderately Certain
□	Reasonable Inference

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs
M - Mating

Table 6, continued. Data reliability

Species/Life Stage		Mid-Atlantic Estuaries						
		Waquoit Bay	Buzzards Bay	Narragansett Bay	Long Island Sound	Connecticut River	Gardiners Bay	Great South Bay
Northern searobin	A	☐	☐	▣	☐	☐	☐	☐
	S	☐	☐	☐	☐	☐	☐	☐
Prionotus carolinus	J	☐	☐	▣	☐	☐	☐	☐
	L	☐	☐	☐	☐	☐	☐	☐
	E	☐	☐	▣	☐	☐	☐	▣
White perch	A	☐	☐	▣	☐	☐	☐	☐
	S	☐	☐	☐	☐	☐	☐	▣
Morone americana	J	☐	☐	▣	☐	☐	☐	☐
	L	☐	☐	☐	☐	☐	☐	▣
	E	☐	☐	☐	☐	☐	☐	▣
Striped bass	A	☐	☐	☐	☐	☐	☐	▣
	S	■	■	▣	▣	▣	▣	▣
Morone saxatilis	J	☐	☐	☐	☐	☐	☐	▣
	L	■	■	▣	▣	▣	▣	■
	E	■	■	▣	☐	▣	▣	■
Black sea bass	A	☐	☐	☐	☐	☐	☐	☐
	S	☐	▣	▣	▣	▣	▣	■
Centropristis striata	J	☐	☐	☐	☐	☐	☐	☐
	L	☐	▣	☐	▣	▣	☐	■
	E	☐	▣	▣	▣	▣	▣	■
Yellow perch	A	☐	☐	☐	☐	☐	▣	■
	S	▣	☐	☐	▣	▣	▣	■
Perca flavescens	J	☐	☐	☐	☐	☐	▣	■
	L	▣	☐	☐	▣	▣	▣	■
	E	▣	☐	☐	▣	▣	▣	■
Bluefish	A	▣	☐	▣	▣	☐	☐	▣
	S	■	▣	■	▣	▣	☐	■
Pomatomus saltatrix	J	▣	☐	☐	☐	☐	☐	☐
	L	☐	☐	☐	▣	▣	☐	■
	E	▣	☐	▣	▣	▣	☐	■
		Waquoit Bay	Buzzards Bay	Narragansett Bay	Long Island Sound	Connecticut River	Gardiners Bay	Great South Bay
		Mid-Atlantic Estuaries						

Data Reliability

■	Highly Certain
▣	Moderately Certain
☐	Reasonable Inference

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs

Table 6, continued. Data reliability

Species/Life Stage		Mid-Atlantic Estuaries						
		Hudson River / Raritan Bay	Barnegat Bay	New Jersey Inland Bays	Delaware Bay	Delaware Inland Bays	Chincoteague Bay	Chesapeake Bay mainstem
Northern searobin	A	▣	▣	▣	▣	▣	■	▣
	S	□	□	□	▣	▣	□	▣
Prionotus carolinus	J	□	□	□	▣	▣	■	▣
	L	□	▣	▣	▣	▣	□	▣
	E	□	▣	▣	▣	▣	□	▣
White perch	A	▣	■	▣	■	▣	▣	▣
	S	▣	■	▣	■	□	■	▣
Morone americana	J	▣	■	▣	■	▣	▣	▣
	L	▣	■	▣	■	□	▣	▣
	E	▣	■	▣	■	□	▣	▣
Striped bass	A	□	▣	▣	▣	▣	▣	▣
	S	▣	▣	▣	▣	■	■	▣
Morone saxatilis	J	□	▣	▣	▣	▣	▣	▣
	L	▣	▣	▣	▣	■	■	▣
	E	▣	▣	▣	▣	■	■	▣
Black sea bass	A	▣	▣	▣	■	▣	■	▣
	S	▣	■	■	■	■	■	■
Centropristis striata	J	▣	▣	▣	■	▣	■	▣
	L	▣	▣	▣	■	■	■	■
	E	▣	▣	▣	■	■	■	□
Yellow perch	A	■	■	▣	▣	▣	▣	▣
	S	□	▣	▣	■	■	▣	▣
Perca flavescens	J	■	■	▣	▣	▣	▣	▣
	L	▣	▣	▣	■	▣	▣	▣
	E	□	▣	▣	■	■	▣	▣
Bluefish	A	▣	■	■	▣	▣	■	▣
	S	▣	■	■	■	■	■	■
Pomatomus saltatrix	J	▣	■	■	■	▣	■	▣
	L	▣	▣	▣	■	▣	■	■
	E	▣	▣	▣	■	■	■	■
		Hudson River / Raritan Bay	Barnegat Bay	New Jersey Inland Bays	Delaware Bay	Delaware Inland Bays	Chincoteague Bay	Chesapeake Bay mainstem
		Mid-Atlantic Estuaries						

Data Reliability	
■	Highly Certain
▣	Moderately Certain
□	Reasonable Inference

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs

Table 6, continued. Data reliability

Species/Life Stage		Mid-Atlantic Estuaries							
		Chester River	Choptank River	Patuxent River	Potomac River	Tangier / Pocomoke Sound	Rappahannock River	York River	James River
Northern searobin *Prionotus carolinus*	A	▣	▣	▣	▣	▣	▣	▣	▣
	S	▣	▣	▣	▣	▣	▣	▣	▣
	J	▣	▣	▣	▣	▣	▣	▣	▣
	L	▣	▣	▣	▣	▣	▣	▣	▣
	E	▣	▣	▣	▣	▣	▣	▣	▣
White perch *Morone americana*	A	□	□	□	□	▣	▣	▣	▣
	S	▣	▣	▣	▣	▣	▣	▣	▣
	J	▣	▣	▣	▣	▣	▣	▣	▣
	L	▣	▣	▣	▣	▣	▣	▣	▣
	E	▣	▣	▣	▣	▣	▣	▣	▣
Striped bass *Morone saxatilis*	A	▣	▣	▣	▣	▣	▣	▣	▣
	S	▣	▣	▣	▣	▣	▣	▣	▣
	J	▣	▣	▣	▣	▣	▣	▣	▣
	L	▣	▣	▣	▣	▣	▣	▣	▣
	E	▣	▣	▣	▣	▣	▣	▣	▣
Black sea bass *Centropristis striata*	A	▣	▣	▣	▣	▣	▣	▣	▣
	S	■	■	■	■	■	■	■	■
	J	▣	▣	▣	▣	▣	▣	▣	▣
	L	■	■	■	■	▣	■	■	■
	E	■	■	■	■	■	■	■	■
Yellow perch *Perca flavescens*	A	▣	▣	▣	▣	□	▣	▣	▣
	S	▣	▣	▣	▣	▣	▣	▣	▣
	J	▣	▣	▣	▣	□	▣	■	▣
	L	▣	▣	▣	▣	□	▣	▣	▣
	E	▣	▣	▣	▣	▣	▣	▣	▣
Bluefish *Pomatomus saltatrix*	A	▣	▣	▣	▣	■	▣	▣	▣
	S	■	■	■	▣	■	■	■	■
	J	▣	▣	▣	▣	■	▣	▣	▣
	L	■	■	■	▣	▣	■	■	■
	E	■	■	■	▣	■	■	■	■
		Chester River	Choptank River	Patuxent River	Potomac River	Tangier / Pocomoke Sound	Rappahannock River	York River	James River
		Mid-Atlantic Estuaries							

Data Reliability

- ■ Highly Certain
- ▣ Moderately Certain
- □ Reasonable Inference

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs

Table 6, continued. Data reliability

		Mid-Atlantic Estuaries						
Species/Life Stage		Waquoit Bay	Buzzards Bay	Narragansett Bay	Long Island Sound	Connecticut River	Gardiners Bay	Great South Bay
Pinfish	A	■	■	■	▣	□	▣	■
	S	■	■	■	■	▣	■	■
Lagodon rhomboides	J	■	■	■	▣	□	▣	■
	L	■	■	■	■	▣	■	■
	E	■	■	■	■	▣	■	■
Scup	A	□	□	▣	□	□	□	□
	S	□	□	▣	▣	▣	□	■
Stenotomus chrysops	J	□	□	▣	□	□	□	□
	L	□	□	□	▣	□	□	■
	E	□	▣	□	▣	□	□	■
Spotted seatrout	A	■	■	■	■	■	■	■
	S	■	■	■	■	■	■	■
Cynoscion nebulosus	J	■	■	■	■	■	■	■
	L	■	■	■	■	■	■	■
	E	■	■	■	■	■	■	■
Weakfish	A	□	□	□	□	□	□	□
	S	□	□	□	▣	▣	□	□
Cynoscion regalis	J	□	□	□	□	□	□	□
	L	□	□	□	▣	□	□	▣
	E	□	□	□	▣	□	□	▣
Spot	A	▣	▣	□	▣	□	□	□
	S	▣	▣	■	■	■	▣	■
Leiostomus xanthurus	J	▣	□	□	▣	□	□	□
	L	▣	▣	▣	■	▣	▣	■
	E	▣	▣	■	■	▣	▣	■
Northern kingfish	A	□	□	□	▣	□	□	□
	S	□	□	□	▣	■	□	▣
Menticirrhus saxatilis	J	□	□	□	▣	□	□	□
	L	□	□	▣	▣	▣	□	▣
	E	□	□	▣	▣	▣	□	▣
		Waquoit Bay	Buzzards Bay	Narragansett Bay	Long Island Sound	Connecticut River	Gardiners Bay	Great South Bay
		Mid-Atlantic Estuaries						

Data Reliability

■ Highly Certain

▣ Moderately Certain

□ Reasonable Inference

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs

Table 6, continued. Data reliability

Species/Life Stage		Mid-Atlantic Estuaries						
		Hudson River / Raritan Bay	Barnegat Bay	New Jersey Inland Bays	Delaware Bay	Delaware Inland Bays	Chincoteague Bay	Chesapeake Bay mainstem
Pinfish *Lagodon rhomboides*	A	▣	▣	□	■	▣	■	▣
	S	▣	■	▣	■	■	■	■
	J	▣	▣	□	■	▣	■	▣
	L	□	▣	▣	■	▣	□	■
	E	□	■	▣	■	▣	■	■
Scup *Stenotomus chrysops*	A	□	■	■	▣	▣	■	▣
	S	□	■	■	▣	■	■	■
	J	□	▣	▣	▣	▣	■	▣
	L	□	■	■	▣	▣	■	■
	E	□	■	■	▣	■	■	■
Spotted seatrout *Cynoscion nebulosus*	A	■	▣	□	▣	▣	▣	▣
	S	■	■	■	▣	■	▣	□
	J	■	▣	□	▣	□	▣	▣
	L	■	■	■	▣	▣	▣	▣
	E	■	■	■	▣	■	▣	□
Weakfish *Cynoscion regalis*	A	▣	■	■	■	■	■	▣
	S	□	▣	▣	▣	▣	□	▣
	J	□	▣	▣	▣	■	■	▣
	L	□	▣	▣	▣	▣	□	▣
	E	□	▣	▣	▣	▣	□	▣
Spot *Leiostomus xanthurus*	A	▣	▣	▣	▣	▣	■	■
	S	▣	■	■	▣	■	■	■
	J	▣	▣	▣	▣	▣	■	▣
	L	□	■	■	▣	▣	■	■
	E	□	■	■	▣	▣	■	■
Northern kingfish *Menticirrhus saxatilis*	A	▣	■	■	■	▣	▣	▣
	S	□	■	■	■	■	■	▣
	J	▣	▣	■	■	▣	▣	▣
	L	□	■	■	■	□	■	■
	E	□	■	■	■	▣	■	▣
		Hudson River / Raritan Bay	Barnegat Bay	New Jersey Inland Bays	Delaware Bay	Delaware Inland Bays	Chincoteague Bay	Chesapeake Bay mainstem
		Mid-Atlantic Estuaries						

Data Reliability

■ Highly Certain

▣ Moderately Certain

□ Reasonable Inference

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs

Table 6, continued. Data reliability

		Mid-Atlantic Estuaries							
Species/Life Stage		Chester River	Choptank River	Patuxent River	Potomac River	Tangier / Pocomoke Sound	Rappa-hannock River	York River	James River
Pinfish	A	■	■	■	■	■	▣	▣	▣
	S	■	■	■	■	■	▣	▣	▣
Lagodon rhomboides	J	■	■	■	■	■	▣	▣	▣
	L	■	■	■	■	■	▣	▣	▣
	E	■	■	■	■	■	▣	▣	▣
Scup	A	■	■	■	■	▣	▣	▣	▣
	S	■	■	■	■	■	■	■	■
Stenotomus chrysops	J	■	■	■	■	▣	▣	▣	▣
	L	■	■	■	■	■	■	■	■
	E	■	■	■	■	■	■	■	■
Spotted seatrout	A	▣	▣	▣	▣	▣	▣	▣	▣
	S	▣	■	■	▣	▣	▣	▣	□
Cynoscion nebulosus	J	▣	▣	▣	▣	▣	▣	▣	▣
	L	▣	□	▣	□	□	▣	▣	▣
	E	▣	▣	■	▣	▣	□	□	□
Weakfish	A	▣	▣	▣	▣	▣	▣	▣	▣
	S	▣	■	■	▣	□	□	▣	□
Cynoscion regalis	J	▣	▣	▣	▣	▣	▣	▣	▣
	L	▣	▣	□	□	□	□	▣	□
	E	▣	■	■	▣	□	□	▣	□
Spot	A	▣	▣	▣	▣	▣	■	■	■
	S	■	■	■	■	■	■	■	■
Leiostomus xanthurus	J	▣	▣	▣	▣	▣	▣	▣	▣
	L	■	▣	■	■	■	■	■	■
	E	■	▣	■	■	■	■	■	■
Northern kingfish	A	■	■	▣	▣	▣	□	□	▣
	S	■	■	■	■	▣	▣	▣	▣
Menticirrhus saxatilis	J	■	■	▣	▣	▣	▣	▣	▣
	L	■	■	■	■	▣	▣	▣	▣
	E	■	■	■	■	▣	▣	▣	▣
		Chester River	Choptank River	Patuxent River	Potomac River	Tangier / Pocomoke Sound	Rappa-hannock River	York River	James River
		Mid-Atlantic Estuaries							

Data Reliability	
■	Highly Certain
▣	Moderately Certain
□	Reasonable Inference

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs

Table 6, continued. Data reliability

Species/Life Stage		Mid-Atlantic Estuaries						
		Waquoit Bay	Buzzards Bay	Narragansett Bay	Long Island Sound	Connecticut River	Gardiners Bay	Great South Bay
Atlantic croaker	A	■	■	▣	▣	▣	□	▣
	S	■	■	■	■	■	▣	■
Micropogonias undulatus	J	■	■	▣	▣	▣	□	▣
	L	■	■	■	■	▣	▣	■
	E	■	■	■	■	▣	▣	■
Black drum	A	▣	■	■	■	▣	▣	▣
	S	■	■	■	■	■	■	■
Pogonias cromis	J	▣	■	■	■	▣	▣	▣
	L	■	■	■	■	▣	■	■
	E	■	■	■	■	▣	■	■
Red drum	A	■	■	▣	■	■	▣	▣
	S	■	■	■	■	■	■	■
Sciaenops ocellatus	J	■	■	▣	■	■	▣	▣
	L	■	■	■	■	■	■	■
	E	■	■	■	■	■	■	■
Mullets	A	□	□	□	□	□	□	□
	S	▣	▣	▣	■	■	▣	■
Mugil species	J	▣	□	□	□	□	□	□
	L	▣	▣	▣	■	▣	▣	■
	E	▣	▣	▣	■	▣	▣	■
Tautog	A	□	□	▣	□	□	□	□
	S	□	▣	□	□	□	□	□
Tautoga onitis	J	□	□	▣	□	□	□	□
	L	□	▣	▣	▣	□	□	■
	E	□	▣	▣	▣	□	□	■
Cunner	A	□	□	□	□	□	□	□
	S	□	□	□	□	□	□	□
Tautogolabrus adspersus	J	□	□	□	□	□	□	□
	L	□	□	□	□	□	□	■
	E	□	□	□	□	□	□	■
		Waquoit Bay	Buzzards Bay	Narragansett Bay	Long Island Sound	Connecticut River	Gardiners Bay	Great South Bay
		Mid-Atlantic Estuaries						

Data Reliability

■ Highly Certain

▣ Moderately Certain

□ Reasonable Inference

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs

Table 6, continued. Data reliability

Species/Life Stage		Mid-Atlantic Estuaries						
		Hudson River / Raritan Bay	Barnegat Bay	New Jersey Inland Bays	Delaware Bay	Delaware Inland Bays	Chincoteague Bay	Chesapeake Bay mainstem
Atlantic croaker	A	▣	■	■	▣	▣	▣	▣
	S	■	■	■	■	■	■	▣
Micropogonias undulatus	J	▣	■	■	▣	▣	▣	▣
	L	▣	■	■	▣	▣	▣	▣
	E	■	■	■	☐	▣	▣	▣
Black drum	A	▣	▣	▣	▣	▣	▣	▣
	S	▣	▣	▣	▣	☐	▣	▣
Pogonias cromis	J	▣	▣	▣	▣	▣	▣	▣
	L	▣	▣	▣	▣	☐	▣	▣
	E	▣	▣	▣	▣	☐	▣	▣
Red drum	A	▣	☐	☐	☐	▣	▣	▣
	S	▣	■	■	■	■	■	■
Sciaenops ocellatus	J	▣	☐	☐	☐	■	▣	▣
	L	▣	■	■	■	▣	■	■
	E	▣	■	■	■	▣	■	■
Mullets	A	☐	▣	▣	▣	▣	■	▣
	S	▣	■	■	■	■	■	■
Mugil species	J	☐	▣	▣	☐	▣	■	▣
	L	▣	■	■	▣	▣	■	■
	E	▣	■	■	■	■	■	■
Tautog	A	▣	▣	▣	▣	☐	■	▣
	S	☐	▣	▣	▣	☐	▣	▣
Tautoga onitis	J	☐	▣	▣	▣	▣	■	▣
	L	☐	▣	▣	▣	▣	▣	▣
	E	☐	▣	▣	▣	▣	▣	▣
Cunner	A	☐	▣	▣	▣	▣	■	▣
	S	☐	▣	▣	▣	▣	▣	■
Tautogolabrus adspersus	J	☐	▣	▣	▣	▣	■	▣
	L	☐	▣	▣	▣	▣	▣	■
	E	☐	▣	▣	▣	▣	▣	■

Hudson River / Raritan Bay | Barnegat Bay | New Jersey Inland Bays | Delaware Bay | Delaware Inland Bays | Chincoteague Bay | Chesapeake Bay mainstem

Mid-Atlantic Estuaries

Data Reliability

■ Highly Certain

▣ Moderately Certain

☐ Reasonable Inference

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs

Table 6, continued. Data reliability

Species/Life Stage		Mid-Atlantic Estuaries							
		Chester River	Choptank River	Patuxent River	Potomac River	Tangier / Pocomoke Sound	Rappa-hannock River	York River	James River
Atlantic croaker	A	▣	▣	▣	▣	▣	☐	▣	▣
	S	■	■	■	■	■	☐	▣	▣
Micropogonias undulatus	J	▣	▣	▣	▣	▣	☐	▣	▣
	L	■	■	▣	■	▣	☐	▣	▣
	E	■	■	■	■	■	☐	▣	▣
Black drum	A	▣	▣	▣	▣	▣	▣	▣	▣
	S	■	■	■	▣	■	▣	▣	■
Pogonias cromis	J	▣	▣	▣	▣	▣	▣	▣	▣
	L	■	■	▣	▣	▣	▣	▣	■
	E	■	■	■	▣	■	▣	▣	■
Red drum	A	■	▣	▣	▣	▣	▣	▣	▣
	S	■	■	▣	▣	■	■	■	■
Sciaenops ocellatus	J	▣	▣	▣	▣	▣	▣	▣	▣
	L	■	■	▣	▣	■	■	■	▣
	E	■	■	▣	▣	■	■	■	▣
Mullets	A	■	▣	▣	▣	▣	☐	▣	▣
	S	■	■	■	▣	■	■	■	■
Mugil species	J	■	▣	▣	▣	▣	☐	▣	▣
	L	■	■	■	▣	■	■	■	■
	E	■	■	■	▣	■	■	■	■
Tautog	A	▣	▣	▣	▣	▣	▣	▣	▣
	S	■	■	■	■	■	▣	▣	▣
Tautoga onitis	J	▣	▣	▣	▣	▣	▣	▣	▣
	L	■	■	■	■	■	▣	▣	▣
	E	■	■	■	■	■	▣	▣	▣
Cunner	A	■	■	■	■	■	■	■	■
	S	■	■	■	■	■	■	■	■
Tautogolabrus adspersus	J	■	■	■	■	■	■	■	■
	L	■	■	■	■	■	■	■	■
	E	■	■	■	■	■	■	■	■

Chester River | Choptank River | Patuxent River | Potomac River | Tangier / Pocomoke Sound | Rappa-hannock River | York River | James River
Mid-Atlantic Estuaries

Data Reliability

■ Highly Certain
▣ Moderately Certain
☐ Reasonable Inference

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs

Table 6, continued. Data reliability

Species/Life Stage		Mid-Atlantic Estuaries						
		Waquoit Bay	Buzzards Bay	Narragansett Bay	Long Island Sound	Connecticut River	Gardiners Bay	Great South Bay
American sand lance *Ammodytes americanus*	A	☐	☐	☐	☐	☐	☐	▣
	S	☐	☐	▣	☐	☐	☐	▣
	J	☐	☐	☐	☐	☐	☐	☐
	L	☐	☐	▣	☐	☐	☐	■
	E	☐	☐	☐	☐	☐	☐	■
Gobies *Gobiosoma species*	A	▣	☐	☐	☐	☐	▣	▣
	S	☐	☐	☐	☐	☐	▣	▣
	J	▣	☐	☐	☐	☐	▣	▣
	L	☐	☐	☐	☐	☐	▣	▣
	E	☐	☐	☐	☐	☐	▣	▣
Atlantic mackerel *Scomber scombrus*	A	☐	▣	☐	☐	▣	☐	☐
	S	▣	▣	▣	■	■	☐	▣
	J	☐	☐	☐	☐	▣	☐	☐
	L	☐	☐	☐	■	▣	▣	▣
	E	☐	☐	▣	■	▣	▣	▣
Butterfish *Peprilus triacanthus*	A	☐	☐	☐	▣	☐	☐	☐
	S	☐	☐	▣	▣	☐	▣	▣
	J	☐	☐	☐	☐	☐	☐	☐
	L	☐	☐	☐	☐	☐	▣	▣
	E	☐	☐	▣	☐	☐	▣	▣
		Waquoit Bay	Buzzards Bay	Narragansett Bay	Long Island Sound	Connecticut River	Gardiners Bay	Great South Bay
		Mid-Atlantic Estuaries						

Data Reliability

■ Highly Certain

▣ Moderately Certain

☐ Reasonable Inference

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs

Table 6, continued. Data reliability

Species/Life Stage		Mid-Atlantic Estuaries						
		Hudson River / Raritan Bay	Barnegat Bay	New Jersey Inland Bays	Delaware Bay	Delaware Inland Bays	Chincoteague Bay	Chesapeake Bay mainstem
American sand lance	A	▣	☐	☐	☐	▣	☐	■
	S	☐	☐	☐	☐	▣	☐	■
Ammodytes americanus	J	▣	☐	☐	☐	▣	☐	■
	L	☐	☐	☐	☐	▣	☐	■
	E	☐	☐	☐	☐	▣	☐	■
Gobies	A	☐	☐	☐	▣	▣	■	▣
	S	☐	▣	▣	▣	☐	☐	☐
Gobiosoma species	J	☐	☐	☐	▣	☐	■	☐
	L	☐	▣	▣	▣	☐	☐	▣
	E	☐	▣	▣	▣	☐	☐	☐
Atlantic mackerel	A	☐	■	■	▣	▣	■	▣
	S	☐	■	■	■	■	■	■
Scomber scombrus	J	☐	▣	▣	■	▣	■	▣
	L	☐	▣	▣	■	▣	■	▣
	E	☐	▣	▣	■	■	■	▣
Butterfish	A	▣	▣	☐	▣	▣	▣	▣
	S	▣	▣	▣	☐	■	■	▣
Peprilus triacanthus	J	☐	▣	▣	▣	▣	▣	■
	L	☐	▣	▣	▣	■	■	▣
	E	☐	▣	▣	▣	■	■	▣

Hudson River / Raritan Bay | Barnegat Bay | New Jersey Inland Bays | Delaware Bay | Delaware Inland Bays | Chincoteague Bay | Chesapeake Bay mainstem

Mid-Atlantic Estuaries

Data Reliability

- ■ Highly Certain
- ▣ Moderately Certain
- ☐ Reasonable Inference

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs

Table 6, continued. Data reliability

Species/Life Stage		Mid-Atlantic Estuaries							
		Chester River	Choptank River	Patuxent River	Potomac River	Tangier / Pocomoke Sound	Rappahannock River	York River	James River
American sand lance *Ammodytes americanus*	A	■	■	■	■	■	■	■	■
	S	■	■	■	■	■	■	■	■
	J	■	■	■	■	■	■	■	■
	L	■	■	■	■	■	■	■	■
	E	■	■	■	■	■	■	■	■
Gobies *Gobiosoma* species	A	☐	☐	☐	☐	☐	▣	▣	▣
	S	☐	☐	☐	☐	☐	▣	▣	▣
	J	☐	☐	☐	☐	☐	▣	▣	☐
	L	☐	☐	■	■	☐	▣	▣	▣
	E	☐	☐	☐	☐	☐	▣	▣	▣
Atlantic mackerel *Scomber scombrus*	A	■	■	■	■	■	▣	▣	▣
	S	■	■	■	■	■	■	■	■
	J	■	■	■	■	■	▣	▣	▣
	L	■	■	■	■	■	■	■	■
	E	■	■	■	■	■	■	■	■
Butterfish *Peprilus triacanthus*	A	■	▣	▣	▣	▣	▣	▣	▣
	S	■	■	■	■	■	▣	▣	▣
	J	■	▣	▣	▣	▣	▣	▣	▣
	L	■	■	■	■	■	▣	▣	▣
	E	■	■	■	■	■	▣	▣	▣
		Chester River	Choptank River	Patuxent River	Potomac River	Tangier / Pocomoke Sound	Rappahannock River	York River	James River
		Mid-Atlantic Estuaries							

Data Reliability

■ Highly Certain

▣ Moderately Certain

☐ Reasonable Inference

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs

Table 6, continued. Data reliability

Species/Life Stage		Mid-Atlantic Estuaries						
		Waquoit Bay	Buzzards Bay	Narragansett Bay	Long Island Sound	Connecticut River	Gardiners Bay	Great South Bay
Summer flounder	A	▣	☐	☐	☐	☐	▣	■
	S	■	■	▣	■	■	■	■
Paralichthys dentatus	J	▣	☐	☐	☐	☐	☐	■
	L	☐	☐	☐	■	▣	▣	■
	E	▣	▣	▣	■	▣	■	■
Windowpane flounder	A	☐	☐	☐	☐	☐	☐	☐
	S	☐	☐	☐	▣	☐	▣	▣
Scophthalamus aquosus	J	☐	☐	☐	☐	☐	☐	☐
	L	☐	☐	▣	▣	☐	▣	▣
	E	☐	☐	☐	▣	☐	▣	▣
Winter flounder	A	■	■	☐	▣	☐	☐	☐
	S	▣	■	☐	▣	☐	☐	☐
Pleuronectes americanus	J	■	■	☐	☐	☐	☐	☐
	L	▣	■	▣	▣	☐	☐	■
	E	▣	■	☐	▣	☐	☐	■
Hogchoker	A	▣	☐	☐	☐	☐	☐	☐
	S	☐	☐	☐	☐	☐	☐	▣
Trinectes maculatus	J	▣	☐	☐	☐	☐	☐	☐
	L	☐	☐	☐	☐	☐	☐	■
	E	☐	☐	☐	☐	☐	☐	■
		Waquoit Bay	Buzzards Bay	Narragansett Bay	Long Island Sound	Connecticut River	Gardiners Bay	Great South Bay
		Mid-Atlantic Estuaries						

Data Reliability

■ Highly Certain

▣ Moderately Certain

☐ Reasonable Inference

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs

Table 6, continued. Data reliability

Species/Life Stage		Mid-Atlantic Estuaries						
		Hudson River / Raritan Bay	Barnegat Bay	New Jersey Inland Bays	Delaware Bay	Delaware Inland Bays	Chincoteague Bay	Chesapeake Bay mainstem
Summer flounder *Paralichthys dentatus*	A	▣	■	■	■	▣	■	▣
	S	▣	■	■	■	■	■	■
	J	▣	▣	▣	■	▣	■	▣
	L	▣	■	■	■	▣	■	▣
	E	▣	■	■	■	▣	■	■
Windowpane flounder *Scophthalamus aquosus*	A	□	■	■	□	▣	■	▣
	S	□	▣	▣	□	□	▣	■
	J	□	■	■	▣	▣	■	▣
	L	□	▣	▣	□	□	▣	▣
	E	□	▣	▣	□	□	▣	■
Winter flounder *Pleuronectes americanus*	A	□	■	■	▣	▣	▣	▣
	S	□	■	■	▣	▣	▣	▣
	J	□	■	■	▣	▣	▣	▣
	L	□	■	■	▣	▣	▣	▣
	E	□	■	■	▣	▣	▣	□
Hogchoker *Trinectes maculatus*	A	▣	■	■	■	▣	■	■
	S	□	■	■	■	▣	□	■
	J	□	■	■	■	▣	■	■
	L	□	■	■	■	▣	□	□
	E	□	■	■	■	▣	□	■

Hudson River / Raritan Bay | Barnegat Bay | New Jersey Inland Bays | Delaware Bay | Delaware Inland Bays | Chincoteague Bay | Chesapeake Bay mainstem

Mid-Atlantic Estuaries

Data Reliability

- ■ Highly Certain
- ▣ Moderately Certain
- □ Reasonable Inference

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs

Table 6, continued. Data reliability

		Mid-Atlantic Estuaries							
Species/Life Stage		Chester River	Choptank River	Patuxent River	Potomac River	Tangier / Pocomoke Sound	Rappahannock River	York River	James River
Summer flounder	A	▣	▣	▣	▣	■	■	■	■
	S	■	■	■	■	■	■	■	■
Paralichthys dentatus	J	▣	▣	▣	▣	■	■	■	■
	L	▣	■	■	■	▣	▣	▣	▣
	E	▣	■	■	■	▣	■	■	■
Windowpane flounder	A	▣	▣	▣	▣	▣	▣	▣	▣
	S	■	■	■	■	■	■	■	■
Scophthalamus aquosus	J	▣	▣	▣	▣	▣	▣	■	▣
	L	■	■	■	■	■	■	■	▣
	E	■	■	■	■	■	■	■	■
Winter flounder	A	▣	▣	▣	▣	▣	▣	▣	▣
	S	▣	▣	▣	▣	▣	▣	▣	▣
Pleuronectes americanus	J	▣	▣	▣	▣	▣	▣	▣	▣
	L	▣	▣	▣	▣	▣	▣	▣	▣
	E	▣	▣	▣	▣	▣	▣	▣	▣
Hogchoker	A	▣	▣	■	▣	■	▣	▣	▣
	S	▣	▣	▣	▣	▣	▣	▣	▣
Trinectes maculatus	J	▣	▣	■	▣	■	▣	▣	▣
	L	□	□	□	□	■	▣	▣	□
	E	▣	▣	▣	▣	▣	▣	▣	▣
		Chester River	Choptank River	Patuxent River	Potomac River	Tangier / Pocomoke Sound	Rappahannock River	York River	James River
		Mid-Atlantic Estuaries							

Data Reliability

■ Highly Certain

▣ Moderately Certain

□ Reasonable Inference

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs

Appendices

Appendix 1. National Estuarine Inventory map of Delaware Bay

Appendix 2. Table of references and personal communications

Appendix 3. Reviewers and personal communications

Appendix 4. References

Appendix 1. National Estuarine Inventory map of Delaware Bay

National Estuarine Atlas

PHYSICAL AND HYDROLOGIC CHARACTERISTICS

PHYSICAL

Surface Areas (mi²)	
Fluvial Drainage	8,700
Estuarine Drainage	4,750
Estuarine Zones	
Tidal Fresh	23
Mixing Zone	200
Seawater	545
Total	768
Dimensions	
Length (mi)	130
Width (mi) Average	15.0
Minimum	4.7
Maximum	28.8
Average Depth (ft)	24.2
Average Depth to Width Ratio	3.1x10⁻⁴
Stratification Classification	
3 Month High Flow	VH
3 Month Low Flow	VH

FRESHWATER INFLOW

Flow Rates (1000 cfs)				
Period of Record	1963 1982			
Long Term Average Daily	19.6			
Long Term Average Monthly	J	23.1	J	13.7
	F	24.3	A	10.3
	M	30.9	S	10.1
	A	32.4	O	12.2
	M	23.9	N	15.7
	J	19.4	D	22.1
7-Day 10-Year Low Flow	2.3			
50-Year Flood	262.7			
100-Year Flood	293.2			
Flow Ratios				
Average Annual	0.006			
High Flow Period	0.013			
Low Flow Period	0.005			

TIDAL DATA

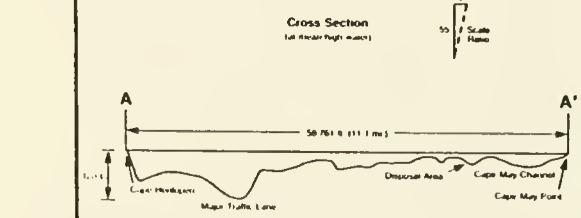
Prevailing Tide: Semidiurnal

Tidal Prism (ft³): 1.02x10¹¹

Phase Range of Tide (ft)

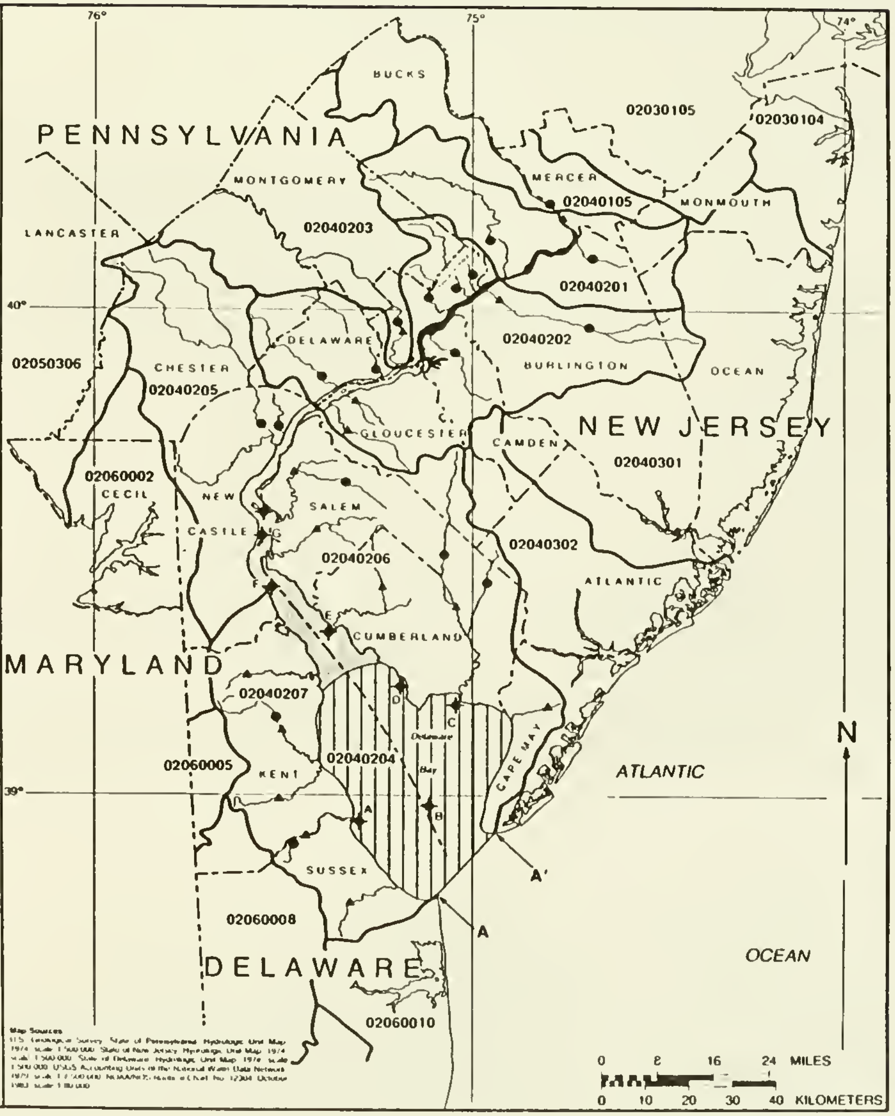
Map Key	Station	Range
A	1809	4.2
B	1783	4.6
C	1768	5.0
D	1779	7.0
E	1791	5.0
F	1823	6.5
G	1827	2.9
H	1841	0.9

Abbreviations: Vertically Homogeneous VH Moderately Stratified MS Highly Stratified HS


Cross Section
(at mean high water)

Notes:
One hundred percent of Estuarine Drainage Area is shown on map. Drainage Divide represents portion of Estuarine Drainage Area boundary not coinciding with U.S. Geological Survey cataloging unit boundary.

References:
Albert, 1982. Ambrose and Roesch, 1982. Buchanan, 1983. Delaware River Basin Commission, 1980. Flippo, 1982. Hatcher and Harleman, 1981. James, et al., 1982. New Jersey Department of Environmental Protection, 1978. Schaefer, et al., 1982. Simmons, 1967. Simmons and Carpenter, 1978. Thatcher and Harleman, 1978. U.S. Department of Commerce, 1983a. Voytik, et al., 1982.



Map Sources:
U.S. Geological Survey, State of Pennsylvania, Hydrologic Unit Map, 1974, scale 1:500,000; State of New Jersey, Hydrologic Unit Map, 1974, scale 1:500,000; State of Delaware, Hydrologic Unit Map, 1974, scale 1:500,000; USGS Accounting Units of the National Water Data Network, 1979, scale 1:2,500,000; NOAA/NOS, Nautical Chart No. 12304, October 1983, scale 1:80,000.

Delaware Bay
DE, NJ, PA, MD

- ✦ Tide Gage
- ● Flow Gage
- ▲ Head of Tide
- ☐ Estuarine Drainage Area (EDA)
- ■ Tidal Fresh Zone
- ▨ Mixing Zone
- ▥ Seawater Zone
- Hydrologic Cataloging Unit Boundary
- County Boundary
- Salinity Zone Boundary - Low Variability
- Salinity Zone Boundary - Moderate Variability
- Salinity Zone Boundary - High Variability

Strategic Assessment Branch
Ocean Assessments Division
Office of Oceanography and Marine Assessment
National Ocean Service - NOAA

Appendix 2. Table of references and personal communications

Species	Waquoit Bay
Blue mussel *Mytilus edulis*	130, 475, 474, 479. Crawford, Deegan.
Bay scallop *Argopecten irradians*	130, 175, 479, 676, 691. Crawford, Deegan.
American oyster *Crassostrea virginica*	130, 479, 613, 661. Crawford, Deegan.
Northern quahog *Mercenaria mercenaria*	130, 479, 657, 659, 691. Crawford, Deegan.
Softshell clam *Mya arenaria*	8, 130, 472, 479. Crawford, Deegan.
Brown shrimp *Peneaus aztecus*	241, 324, 746. Crawford, Deegan.
Daggerblade grass shrimp *Palaemonetes pugio*	14, 130, 488, 722, 746. Crawford, Deegan.
Sevenspine bay shrimp *Crangon septemspinosa*	130, 222, 241, 451, 746. Crawford, Deegan.
American lobster *Homarus americanus*	130, 241, 366, 746. Crawford, Deegan.
Blue crab *Callinectes sapidus*	130, 253, 479. Crawford, Deegan.
Skates *Raja* species	34, 35, 264, 360. Crawford, Deegan.
Atlantic stingray *Dasyatus sabina*	35. Crawford, Deegan.
Cownose ray *Rhinoptera bonansus*	34, 35. Crawford, Deegan.
Shortnose sturgeon *Acipenser brevirostrum*	34, 99, 132, 201, 287. Crawford, Deegan, Hurley.
Atlantic sturgeon *Acipenser oxyrhynchus*	34, 99, 201, 287. Crawford, Deegan.
American eel *Anguilla rostrata*	23, 34, 130, 141, 170, 230, 241, 244, 264, 360, 479. Crawford, Deegan, Hurley.
Blueback herring *Alosa aestivalis*	23, 34, 130, 141, 264, 287, 346, 464, 479. Crawford, Deegan.
Alewife *Alosa pseudoharengus*	23, 34, 130, 141, 173, 264, 287, 346, 464, 479. Crawford, Deegan, Hurley.
American shad *Alosa sapidissima*	23, 34, 131, 287, 367, 720. Crawford, Deegan.
Atlantic menhaden *Brevoortia tyrannus*	23, 34, 109, 130, 141, 264, 287, 402, 479, 574. Crawford, Deegan.
Atlantic herring *Clupea harengus*	23, 34, 109, 141, 241, 287, 297. Crawford, Deegan.
Bay anchovy *Anchoa mitchilli*	23, 34, 141, 264, 287, 459. Crawford, Deegan.
Channel catfish *Ictalurus punctatus*	287, 226. Crawford, Deegan, Hurley.
Rainbow smelt *Osmerus mordax*	34, 70, 99, 130, 264, 360, 479. Crawford, Deegan.
Atlantic salmon *Salmo salar*	34, 99, 135. Crawford, Deegan, Hurley.
Atlantic cod *Gadus morhua*	34, 130, 230, 479, 732. Crawford, Deegan.
Haddock *Melanogrammus aeglefinus*	34, 230. Crawford, Deegan.
Atlantic tomcod *Microgadus tomcod*	23, 34, 130, 230, 241, 264, 360, 479, 665. Crawford, Deegan.
Pollock *Pollachius virens*	23, 34, 109, 130, 230, 241, 360, 479. Crawford, Deegan.
Red hake *Urophycis chuss*	34, 99, 109, 230, 241, 360, 386, 468. Crawford, Deegan.

Numbers correspond to references listed in Appendix 4, pp. 245-280.
Names correspond to individuals listed in Appendix 3, pp. 239-243.

Species	Waquoit Bay, continued
Oyster toadfish *Opsanus tau*	23, 34, 130, 141, 264, 390, 479. Crawford, Deegan.
Sheepshead minnow *Cyprinodon variegatus*	23, 34, 130, 141, 230, 264, 479. Crawford, Deegan.
Killifishes *Fundulus* species	7, 23, 34, 130, 141, 230, 241, 264, 479. Crawford, Deegan, Hurley.
Silversides *Menidia* species	23, 34, 112, 130, 141, 174, 241, 264, 360, 390, 479. Crawford, Deegan.
Northern pipefish *Syngnathus fuscus*	23, 34, 130, 141, 230, 241, 264, 330, 360, 479. Crawford, Deegan.
Northern searobin *Prionotus carolinus*	23, 34, 99, 109, 130, 141, 195, 264, 360, 479, 565. Crawford, Deegan.
White perch *Morone americana*	23, 34, 141, 231, 264, 479, 658. Crawford, Deegan, Hurley.
Striped bass *Morone saxatilis*	23, 34, 45, 99, 130, 141, 176, 231, 264, 479, 701. Crawford, Deegan.
Black sea bass *Centropristis striata*	23, 34, 130, 141, 231, 241, 360, 436, 479. Crawford, Deegan.
Yellow perch *Perca flavescens*	226, 231, 264. Crawford, Deegan, Hurley.
Bluefish *Pomatomus saltatrix*	23, 34, 99, 130, 141, 231, 264, 298, 479, 497. Crawford, Deegan.
Pinfish *Lagodon rhomboides*	285, 465. Crawford, Deegan.
Scup *Stenotomus chrysops*	23, 34, 99, 130, 141, 241, 264, 285, 360, 457, 479. Crawford, Deegan.
Spotted seatrout *Cynoscion nebulosus*	284, 285. Crawford, Deegan.
Weakfish *Cynoscion regalis*	34, 99, 285, 435. Crawford, Deegan.
Spot *Leiostomus xanthurus*	34, 285, 533. Crawford, Deegan.
Northern kingfish *Menticirrhus saxatilis*	34, 285, 360, 479. Crawford, Deegan.
Atlantic croaker *Micropogonias undulatus*	285, 326. Crawford, Deegan.
Black drum *Pogonias cromis*	34, 285, 671. Crawford, Deegan.
Red drum *Sciaenops ocellatus*	285, 552. Crawford, Deegan.
Mullets *Mugil* species	23, 34, 107, 130, 141, 264, 390, 479. Crawford, Deegan.
Tautog *Tautoga onitis*	19, 23, 34, 109, 130, 141, 195, 241, 264, 360, 479, 498, 651. Crawford, Deegan.
Cunner *Tautogolabrus adspersus*	19, 23, 34, 109, 130, 141, 195, 241, 264, 360, 479. Crawford, Deegan.
American sand lance *Ammodytes americanus*	20, 23, 34, 130, 141, 195, 241, 264, 479. Crawford, Deegan.
Gobies *Gobiosoma* species	23, 141, 195, 360. Crawford, Deegan.
Atlantic mackerel *Scomber scombrus*	34, 99, 195, 264, 508. Crawford, Deegan.
Butterfish *Peprilus triacanthus*	34, 109, 264, 360, 390, 466. Crawford, Deegan.
Summer flounder *Paralichthys dentatus*	4, 23, 34, 99, 130, 141, 210, 390, 360, 479. Crawford, Deegan.
Windowpane flounder *Scophthalmus aquousus*	23, 34, 99, 141, 241, 264, 390, 680. Crawford, Deegan.
Winter flounder *Pleuronectes americanus*	23, 34, 71, 99, 130, 141, 210, 241, 267, 360, 390, 409, 594, 595. Crawford, Deegan.
Hogchoker *Trinectes maculatus*	23, 34, 99, 141, 264, 390. Crawford, Deegan.

Numbers correspond to references listed in Appendix 4, pp. 245-280.
Names correspond to individuals listed in Appendix 3, pp. 239-243.

Appendix 2, continued. Table of references and personal communications

Species	Buzzards Bay
Blue mussel *Mytilus edulis*	269, 474, 567. Hickey, Currier, Correia, Cadrin, Howe.
Bay scallop *Argopecten irradians*	81, 157, 175, 269, 369. Hickey, Currier, Correia, Cadrin, Howe.
American oyster *Crassostrea virginica*	76, 81, 211, 369, 613, 660, 661, 727. Hickey, Currier, Correia, Cadrin, Howe.
Northern quahog *Mercenaria mercenaria*	81, 157, 167, 211, 269, 369, 657, 659, 727. Hickey, Currier, Correia, Cadrin, Howe.
Softshell clam *Mya arenaria*	8, 81, 369, 472, 727. Hickey, Currier, Correia, Cadrin, Howe.
Brown shrimp *Peneaus aztecus*	324, 327, 746. Currier, Correia, Cadrin, Howe.
Daggerblade grass shrimp *Palaemonetes pugio*	14, 188, 746. Currier, Correia, Cadrin, Howe.
Sevenspine bay shrimp *Crangon septemspinosa*	117, 118, 188, 221, 746. Currier, Correia, Cadrin, Howe.
American lobster *Homarus americanus*	80, 100, 106, 166, 211, 269, 293, 294, 313, 357, 366, 746. Currier, Correia, Cadrin, Howe, Estrella, Collings, Scherer.
Blue crab *Callinectes sapidus*	211, 253, 269, 525, 694, 745, 746. Currier, Correia, Cadrin, Howe.
Skates *Raja* species	34, 35, 172, 211, 264, 269, 360. Currier, Correia, Cadrin, Howe, Scherer.
Atlantic stingray *Dasyatus sabina*	35. Currier, Correia, Cadrin, Howe.
Cownose ray *Rhinoptera bonansus*	34, 35. Currier, Correia, Cadrin, Howe.
Shortnose sturgeon *Acipenser brevirostrum*	34, 132, 201, 287, 727. Currier, Correia, Cadrin, Howe, Scherer.
Atlantic sturgeon *Acipenser oxyrhynchus*	34, 201, 287, 693, 727. Currier, Correia, Cadrin, Howe, Scherer.
American eel *Anguilla rostrata*	34, 170, 172, 230, 264, 269, 333, 360, 361, 692, 727, 729. Currier, Correia, Cadrin, Howe, Scherer.
Blueback herring *Alosa aestivalis*	34, 172, 173, 211, 264, 269, 287, 333, 464, 727. Currier, Correia, Cadrin, Howe, Scherer.
Alewife *Alosa pseudoharengus*	34, 172, 173, 211, 269, 287, 333, 360, 464, 727. Currier, Correia, Cadrin, Howe, Scherer.
American shad *Alosa sapidissima*	34, 169, 211, 269, 287, 367, 720, 727. Currier, Correia, Cadrin, Howe, Scherer.
Atlantic menhaden *Brevoortia tyrannus*	34, 82, 106, 172, 211, 264, 269, 287, 333, 360, 361, 572, 574, 727, 729. Currier, Correia, Cadrin, Collings, Howe, Scherer.
Atlantic herring *Clupea harengus*	34, 82, 106, 172, 211, 264, 269, 287, 297, 361, 438, 727, 729. Currier, Correia, Cadrin, Collings, Howe, Scherer.
Bay anchovy *Anchoa mitchilli*	34, 82, 106, 188, 211, 264, 269, 287, 333, 361, 459, 566, 729. Currier, Correia, Cadrin, Collings, Howe, Scherer.
Channel catfish *Ictalurus punctatus*	287. Currier, Correia, Cadrin, Howe.
Rainbow smelt *Osmerus mordax*	34, 70, 103, 127, 172, 264, 269, 333, 360, 727. Currier, Correia, Cadrin, Howe, Scherer.
Atlantic salmon *Salmo salar*	34, 36, 135. Currier, Correia, Cadrin, Howe, Scherer.
Atlantic cod *Gadus morhua*	34, 82, 106, 172, 211, 230, 268, 269, 361, 438, 647, 727. Currier, Correia, Cadrin, Collings, Howe, Scherer.
Haddock *Melanogrammus aeglefinus*	34, 82, 106, 211, 230, 269, 333, 647, 727. Currier, Correia, Cadrin, Howe, Scherer.
Atlantic tomcod *Microgadus tomcod*	34, 82, 103, 106, 172, 230, 264, 265, 269, 333, 360, 665, 727. Currier, Correia, Cadrin, Howe, Collings, Scherer.
Pollock *Pollachius virens*	82, 106, 172, 230, 269, 360, 361, 727. Currier, Correia, Cadrin, Collings, Howe, Scherer.
Red hake *Urophycis chuss*	34, 82, 106, 172, 211, 230, 269, 333, 360, 361, 438, 727. Currier, Correia, Cadrin, Collings, Howe, Scherer.

Numbers correspond to references listed in Appendix 4, pp. 245-280.
Names correspond to individuals listed in Appendix 3, pp. 239-243.

Species	Buzzards Bay, continued
Oyster toadfish *Opsanus tau*	34, 264, 269, 333, 390. Currier, Correia, Cadrin, Howe, Scherer.
Sheepshead minnow *Cyprinodon variegatus*	34, 230, 264, 333. Currier, Correia, Cadrin, Howe, Scherer.
Killifishes *Fundulus* species	7, 34, 172, 188, 230, 264, 333, 360, 361, 704. Currier, Correia, Cadrin, Howe, Scherer.
Silversides *Menidia* species	34, 82, 106, 172, 174, 188, 262, 264, 269, 333, 360, 361, 390, 677, 705, 729. Currier, Correia, Cadrin, Howe, Scherer.
Northern pipefish *Syngnathus fuscus*	34, 82, 106, 172, 230, 264, 269, 330, 333, 360, 438, 729. Currier, Correia, Cadrin, Collings, Howe, Scherer.
Northern searobin *Prionotus carolinus*	34, 82, 106, 172, 195, 211, 264, 269, 333, 360, 729. Currier, Correia, Cadrin, Collings, Howe, Scherer.
White perch *Morone americana*	34, 231, 264, 333, 658, 727. Currier, Correia, Cadrin, Howe, Scherer.
Striped bass *Morone saxatilis*	34, 73, 168, 172, 176, 211, 231, 252, 264, 333, 351, 600, 727. Currier, Correia, Cadrin, Howe, Scherer.
Black sea bass *Centropristis striata*	34, 82, 106, 211, 231, 268, 269, 313, 360, 436. Currier, Correia, Cadrin, Collings, Howe, Scherer.
Yellow perch *Perca flavescens*	231, 264, 333. Currier, Correia, Cadrin, Howe.
Bluefish *Pomatomus saltatrix*	34, 172, 188, 211, 231, 264, 298, 329, 333, 356, 361, 497, 537, 727. Currier, Correia, Cadrin, Howe, Scherer.
Pinfish *Lagodon rhomboides*	285, 465. Currier, Correia, Cadrin, Howe, Scherer.
Scup *Stenotomus chrysops*	34, 82, 106, 172, 211, 264, 268, 269, 285, 313, 333, 360, 361, 438, 457, 727, 729. Currier, Correia, Cadrin, Collings, Howe, Scherer.
Spotted seatrout *Cynoscion nebulosus*	328, 284, 285. Currier, Correia, Cadrin, Howe, Scherer.
Weakfish *Cynoscion regalis*	34, 82, 106, 211, 269, 285, 435, 438, 622, 727, 729. Currier, Correia, Cadrin, Collings, Howe, Scherer.
Spot *Leiostomus xanthurus*	34, 223, 211, 269, 285, 533, 727. Currier, Correia, Cadrin, Howe, Scherer.
Northern kingfish *Menticirrhus saxatilis*	34, 82, 106, 211, 269, 285, 333, 360, 729. Currier, Correia, Cadrin, Collings, Howe, Scherer.
Atlantic croaker *Micropogonias undulatus*	211, 285, 326, 727. Currier, Correia, Cadrin, Howe, Scherer.
Black drum *Pogonias cromis*	34, 285, 671. Currier, Correia, Cadrin, Howe, Scherer.
Red drum *Sciaenops ocellatus*	285, 552. Currier, Correia, Cadrin, Howe, Scherer.
Mullets *Mugil* species	34, 107, 108, 264, 333, 390. Currier, Correia, Cadrin, Howe, Scherer.
Tautog *Tautoga onitis*	19, 34, 82, 103, 106, 172, 195, 264, 269, 313, 333, 360, 438, 667, 727, 729. Currier, Correia, Cadrin, Collings, Howe, Scherer.
Cunner *Tautogolabrus adspersus*	19, 34, 82, 103, 106, 172, 195, 269, 313, 333, 360, 361, 438, 614, 615, 729. Currier, Correia, Cadrin, Collings, Howe, Scherer.
American sand lance *Ammodytes americanus*	20, 34, 82, 106, 172, 195, 211, 264, 269, 333, 361, 560, 561, 729. Currier, Correia, Cadrin, Collings, Howe, Scherer.
Gobies *Gobiosoma* species	50, 82, 106, 136, 195, 269, 333, 621. Currier, Correia, Cadrin, Howe, Scherer.
Atlantic mackerel *Scomber scombrus*	34, 82, 106, 172, 195, 211, 264, 269, 333, 438, 727. Currier, Correia, Cadrin, Collings, Howe, Scherer.
Butterfish *Peprilus triacanthus*	34, 82, 106, 172, 211, 269, 360, 361, 390, 438, 727. Currier, Correia, Cadrin, Howe, Scherer.
Summer flounder *Paralichthys dentatus*	34, 49, 82, 106, 210, 211, 268, 269, 333, 360, 390, 438, 573, 727. Currier, Correia, Cadrin, Howe, Scherer.
Windowpane flounder *Scophthalmus aquousus*	34, 106, 172, 211, 264, 269, 333, 361, 390, 438, 727, 729. Currier, Correia, Cadrin, Collings, Howe, Scherer.
Winter flounder *Pleuronectes americanus*	34, 49, 71, 82, 103, 106, 172, 210, 211, 264, 266, 267, 268, 269, 333, 360, 361, 390, 535, 570, 681, 727, 729. Currier, Correia, Cadrin, Howe, Scherer.
Hogchoker *Trinectes maculatus*	34, 82, 106, 269, 333, 390. Currier, Correia, Cadrin, Collings, Howe, Scherer.

Numbers correspond to references listed in Appendix 4, pp. 245-280.
Names correspond to individuals listed in Appendix 3, pp. 239-243.

Appendix 2, continued. Table of references and personal communications

Species	Narragansett Bay
Blue mussel *Mytilus edulis*	183, 474, 567. Rice, Ganz.
Bay scallop *Argopecten irradians*	175, 191, 369, 505, 727. Rice, Ganz, Jeffries, Douglason.
American oyster *Crassostrea virginica*	76, 191, 211, 369, 505, 613, 660, 661, 727. Rice, Ganz, Jeffries, Douglason.
Northern quahog *Mercenaria mercenaria*	167, 183, 191, 211, 249, 369, 504, 505, 543, 544, 657, 659, 727. Rice, Ganz, Jeffries, Douglason.
Softshell clam *Mya arenaria*	8, 191, 369, 472, 505, 727. Rice, Ganz, Jeffries, Douglason.
Brown shrimp *Peneaus aztecus*	324, 327, 746. Ganz, Rice.
Daggerblade grass shrimp *Palaemonetes pugio*	14, 188, 722, 746. Rice, Jeffries.
Sevenspine bay shrimp *Crangon septemspinosa*	117, 118, 188, 191, 221, 254, 733, 734, 746. Rice, Jeffries, Douglason.
American lobster *Homarus americanus*	101, 182, 191, 211, 366, 505, 727, 746. Rice, Ganz, Jeffries, Douglason.
Blue crab *Callinectes sapidus*	191, 211, 253, 254, 505, 525, 694, 727, 745, 746. Rice, Ganz, Jeffries, Douglason.
Skates *Raja* species	34, 35, 129, 211, 504, 509, 538, 539, 540, 541. T. Lynch, Keller, Klein-MacPhee, Jeffries, Douglason.
Atlantic stingray *Dasyatus sabina*	35. T. Lynch, Keller, Klein-MacPhee, Jeffries, Douglason.
Cownose ray *Rhinoptera bonansus*	34, 35, 363. T. Lynch, Keller, Klein-MacPhee, Jeffries, Douglason.
Shortnose sturgeon *Acipenser brevirostrum*	34, 132, 201, 287, 727. T. Lynch, Keller, Klein-MacPhee, Jeffries, Douglason.
Atlantic sturgeon *Acipenser oxyrhynchus*	34, 201, 287, 693, 727. T. Lynch, Keller, Klein-MacPhee, Jeffries, Douglason.
American eel *Anguilla rostrata*	33, 34, 46, 129, 158, 170, 230, 245, 246, 309, 363, 364, 504, 505, 509, 538, 539, 540, 541, 626, 627, 692, 727, 729. Lynch, Keller, Klein-MacPhee, Jeffries, Douglason.
Blueback herring *Alosa aestivalis*	34, 46, 129, 158, 173, 211, 245, 246, 287, 309, 464, 504, 509, 626, 627, 727. T. Lynch, Keller, Klein-MacPhee, Jeffries, Douglason.
Alewife *Alosa pseudoharengus*	34, 114, 129, 158, 173, 211, 245, 246, 287, 309, 464, 504, 505, 538, 539, 540, 541, 591, 626, 627, 727. T. Lynch, Keller, Klein-MacPhee, Jeffries, Douglason.
American shad *Alosa sapidissima*	34, 46, 158, 169, 211, 245, 246, 287, 309, 363, 364, 367, 509, 720, 727. T. Lynch, Keller, Klein-MacPhee, Jeffries, Douglason.
Atlantic menhaden *Brevoortia tyrannus*	34, 46, 129, 158, 211, 245, 246, 287, 309, 363, 364, 504, 505, 509, 538, 539, 540, 541, 572, 574, 626, 627, 727, 729. T. Lynch, Keller, Klein-MacPhee, Jeffries, Douglason.
Atlantic herring *Clupea harengus*	34, 46, 129, 158, 211, 245, 246, 287, 297, 438, 504, 505, 509, 538, 539, 540, 541, 626, 627, 727, 729. T. Lynch, Keller, Klein-MacPhee, Jeffries, Douglason.
Bay anchovy *Anchoa mitchilli*	34, 46, 129, 158, 188, 211, 245, 246, 287, 309, 363, 364, 459, 509, 538, 539, 540, 541, 566, 626, 627, 729. T. Lynch, Keller, Klein-MacPhee, Jeffries, Douglason.
Channel catfish *Ictalurus punctatus*	129, 287. T. Lynch, Keller, Klein-MacPhee, Jeffries, Douglason.
Rainbow smelt *Osmerus mordax*	34, 46, 70, 129, 158, 245, 246, 363, 364, 504, 538, 539, 540, 541, 626, 627, 727. T. Lynch, Keller, Klein-MacPhee, Jeffries, Douglason.
Atlantic salmon *Salmo salar*	34, 36, 135. T. Lynch, Keller, Klein-MacPhee, Jeffries, Douglason.
Atlantic cod *Gadus morhua*	34, 46, 158, 211, 230, 245, 246, 309, 363, 364, 438, 504, 505, 509, 626, 627, 647, 727. T. Lynch, Keller, Klein-MacPhee, Jeffries, Douglason.
Haddock *Melanogrammus aeglefinus*	34, 46, 158, 211, 230, 245, 246, 309, 364, 505, 509, 626, 627, 647, 727. T. Lynch, Keller, Klein-MacPhee, Jeffries, Douglason.
Atlantic tomcod *Microgadus tomcod*	34, 46, 158, 230, 309, 363, 364, 504, 538, 539, 540, 541, 665, 727. T. Lynch, Keller, Klein-MacPhee, Jeffries, Douglason.
Pollock *Pollachius virens*	46, 158, 230, 245, 246, 309, 363, 364, 504, 505, 626, 627, 727. T. Lynch, Keller, Klein-MacPhee, Jeffries, Douglason.
Red hake *Urophycis chuss*	34, 158, 211, 230, 245, 246, 277, 309, 363, 364, 438, 504, 505, 509, 626, 627, 727. T. Lynch, Keller, Klein-MacPhee, Jeffries, Douglason.

Numbers correspond to references listed in Appendix 4, pp. 245-280.
Names correspond to individuals listed in Appendix 3, pp. 239-243.

Species	Narragansett Bay, continued
Oyster toadfish *Opsanus tau*	34, 46, 129, 158, 245, 246, 309, 363, 364, 390, 504, 509, 538, 539, 540, 541. T. Lynch, Keller, Klein-MacPhee, Jeffries, Douglason.
Sheepshead minnow *Cyprinodon variegatus*	34, 129, 230, 538, 539, 540, 541. T. Lynch, Keller, Klein-MacPhee, Jeffries, Douglason.
Killifishes *Fundulus* species	7, 34, 46, 129, 158, 188, 230, 245, 246, 309, 509, 538, 539, 540, 541. T. Lynch, Keller, Klein-MacPhee, Jeffries, Douglason.
Silversides *Menidia* species	34, 46, 129, 158, 174, 188, 245, 246, 309, 363, 364, 390, 509, 538, 539, 540, 541, 626, 627, 677, 705, 729. T. Lynch, Keller, Klein-MacPhee, Jeffries, Douglason.
Northern pipefish *Syngnathus fuscus*	34, 46, 129, 158, 230, 245, 246, 309, 330, 363, 364, 438, 538, 539, 540, 541, 626, 627, 729. T. Lynch, Keller, Klein-MacPhee, Jeffries, Douglason.
Northern searobin *Prionotus carolinus*	34, 46, 129, 158, 195, 211, 245, 246, 309, 363, 364, 504, 626, 627, 729. T. Lynch, Keller, Klein-MacPhee, Jeffries, Douglason.
White perch *Morone americana*	34, 129, 231, 509, 658, 727. T. Lynch, Keller, Klein-MacPhee, Jeffries, Douglason.
Striped bass *Morone saxatilis*	34, 73, 129, 168, 176, 211, 231, 252, 351, 504, 505, 538, 539, 540, 541, 600, 727. T. Lynch, Keller, Klein-MacPhee, Jeffries, Douglason.
Black sea bass *Centropristis striata*	34, 46, 129, 158, 211, 231, 245, 246, 309, 363, 364, 436, 538, 539, 540, 541. T. Lynch, Keller, Klein-MacPhee, Jeffries, Douglason.
Yellow perch *Perca flavescens*	129, 231, 278, 363. T. Lynch, Keller, Klein-MacPhee, Jeffries, Douglason.
Bluefish *Pomatomus saltatrix*	34, 46, 129, 158, 188, 207, 211, 231, 245, 246, 298, 309, 356, 363, 364, 497, 504, 505, 537, 538, 539, 540, 541, 626, 627, 727. T. Lynch, Keller, Klein-MacPhee, Jeffries, Douglason.
Pinfish *Lagodon rhomboides*	129, 285, 465. T. Lynch, Keller, Klein-MacPhee, Jeffries, Douglason.
Scup *Stenotomus chrysops*	34, 46, 129, 158, 208, 211, 245, 246, 277, 285, 309, 363, 364, 438, 443, 457, 504, 505, 538, 539, 540, 541, 626, 627, 630, 727, 729. T. Lynch, Keller, Klein-MacPhee, Jeffries, Douglason.
Spotted seatrout *Cynoscion nebulosus*	129, 284, 285, 328. T. Lynch, Keller, Klein-MacPhee, Jeffries, Douglason.
Weakfish *Cynoscion regalis*	34, 46, 129, 158, 211, 245, 246, 285, 309, 363, 364, 438, 435, 504, 538, 539, 540, 541, 622, 626, 627, 727, 729. T. Lynch, Keller, Klein-MacPhee, Jeffries, Douglason.
Spot *Leiostomus xanthurus*	34, 46, 129, 158, 223, 211, 245, 246, 285, 309, 363, 364, 509, 533, 727. T. Lynch, Keller, Klein-MacPhee, Jeffries, Douglason.
Northern kingfish *Menticirrhus saxatilis*	34, 129, 211, 245, 246, 285, 363, 364, 504, 538, 539, 540, 541, 626, 627, 729. T. Lynch, Keller, Klein-MacPhee, Jeffries, Douglason.
Atlantic croaker *Micropogonias undulatus*	211, 326, 285, 727. T. Lynch, Keller, Klein-MacPhee, Jeffries, Douglason.
Black drum *Pogonias cromis*	34, 129, 285, 671. T. Lynch, Keller, Klein-MacPhee, Jeffries, Douglason.
Red drum *Sciaenops ocellatus*	285, 552. T. Lynch, Keller, Klein-MacPhee, Jeffries, Douglason.
Mullets *Mugil* species	34, 46, 107, 108, 129, 158, 245, 246, 309, 390, 509, 538, 539, 540, 541. T. Lynch, Keller, Klein-MacPhee, Jeffries, Douglason.
Tautog *Tautoga onitis*	19, 34, 46, 93, 115, 129, 158, 195, 245, 246, 309, 363, 364, 438, 504, 505, 538, 539, 540, 541, 626, 627, 727, 729. T. Lynch, Keller, Klein-MacPhee, Jeffries, Douglason.
Cunner *Tautogolabrus adspersus*	19, 34, 46, 129, 158, 195, 245, 246, 309, 363, 364, 438, 504, 538, 539, 540, 541, 626, 627, 729. T. Lynch, Keller, Klein-MacPhee, Jeffries, Douglason.
American sand lance *Ammodytes americanus*	20, 34, 46, 129, 158, 195, 211, 245, 246, 309, 363, 364, 538, 539, 540, 541, 560, 561, 626, 627, 729. T. Lynch, Keller, Klein-MacPhee, Jeffries, Douglason.
Gobies *Gobiosoma* species	46, 50, 129, 136, 195, 158, 245, 246, 309, 363, 364, 538, 539, 540, 541, 621, 626, 627. T. Lynch, Keller, Klein-MacPhee, Jeffries, Douglason.
Atlantic mackerel *Scomber scombrus*	34, 46, 129, 158, 195, 211, 245, 246, 309, 363, 364, 438, 504, 505, 538, 539, 540, 541, 626, 627, 727. T. Lynch, Keller, Klein-MacPhee, Jeffries, Douglason.
Butterfish *Peprilus triacanthus*	34, 129, 158, 211, 245, 246, 309, 363, 364, 390, 438, 504, 505, 626, 627, 727. T. Lynch, Keller, Klein-MacPhee, Jeffries, Douglason.
Summer flounder *Paralichthys dentatus*	34, 46, 49, 129, 158, 210, 211, 309, 363, 364, 573, 390, 438, 504, 505, 509, 538, 539, 540, 541, 626, 627, 727. T. Lynch, Keller, Klein-MacPhee, Jeffries, Douglason.
Windowpane flounder *Scophthalmus aquousus*	34, 46, 129, 158, 211, 245, 246, 309, 390, 438, 509, 538, 539, 540, 541, 626, 627, 727, 729. T. Lynch, Keller, Klein-MacPhee, Jeffries, Douglason.
Winter flounder *Pleuronectes americanus*	34, 46, 49, 72, 71, 129, 158, 209, 210, 211, 220, 245, 246, 277, 279, 309, 363, 364, 390, 504, 505, 509, 521, 538, 539, 540, 541, 570, 590, 626, 627, 727, 729. T. Lynch, Keller, Klein-MacPhee, Jeffries, Douglason.
Hogchoker *Trinectes maculatus*	34, 46, 129, 158, 245, 246, 309, 363, 364, 390, 509, 626, 627. T. Lynch, Keller, Klein-MacPhee, Jeffries, Douglason.

Numbers correspond to references listed in Appendix 4, pp. 245-280.
Names correspond to individuals listed in Appendix 3, pp. 239-243.

Appendix 2, continued. Table of references and personal communications

Species	Long Island Sound
Blue mussel *Mytilus edulis*	177, 474, 519, 567. Briggs, Fox, MacKenzie, Cerrato, Volk.
Bay scallop *Argopecten irradians*	175, 369, 682. Briggs, Fox, MacKenzie, Cerrato, Volk.
American oyster *Crassostrea virginica*	76, 211, 369, 417, 519, 613, 660, 661, 682, 727. Briggs, Fox, MacKenzie, Cerrato, Volk.
Northern quahog *Mercenaria mercenaria*	167, 185, 211, 295, 369, 417, 519, 657, 659, 666, 682, 727. Briggs, Fox, Cerrato, MacKenzie, Volk.
Softshell clam *Mya arenaria*	8, 61, 62, 63, 369, 472, 519, 682, 727. Briggs, Fox, MacKenzie, Cerrato, Volk.
Brown shrimp *Peneaus aztecus*	324, 327, 682, 746. Briggs, MacKenzie, Cerrato, Fox.
Daggerblade grass shrimp *Palaemonetes pugio*	10, 11, 12, 13, 14, 188, 682, 746. Briggs, Cerrato, Fox, MacKenzie.
Sevenspine bay shrimp *Crangon septemspinosa*	10, 11, 12, 13, 117, 118, 188, 221, 451, 682, 746. Briggs, Cerrato, Fox, MacKenzie.
American lobster *Homarus americanus*	10, 11, 12, 13, 38, 54, 56, 57, 58, 211, 304, 305, 306, 357, 366, 372, 373, 417, 632, 738, 746. Briggs, Cerrato, Fox, MacKenzie.
Blue crab *Callinectes sapidus*	211, 253, 525, 682, 694, 738, 745, 746. Briggs, Cerrato, Fox, MacKenzie.
Skates *Raja* species	10, 11, 12, 13, 34, 35, 211, 248, 305, 372, 373, 556, 557, 558, 738, 739, 741, 758. Howell, Savoy, Gauthier, Monteleone, Young, McKown.
Atlantic stingray *Dasyatus sabina*	35, 741. Howell, Savoy, Ephart, Gauthier, Monteleone, Young, McKown.
Cownose ray *Rhinoptera bonansus*	34, 35, 248, 741. Howell, Savoy, Gauthier, Monteleone, Young, McKown.
Shortnose sturgeon *Acipenser brevirostrum*	34, 69, 132, 201, 248, 287, 727. Howell, Savoy, Ephart, Gauthier, Monteleone, Young, McKown.
Atlantic sturgeon *Acipenser oxyrhynchus*	34, 201, 248, 287, 305, 372, 373, 693, 727, 739, 741. Howell, Savoy, Ephart, Gauthier, Monteleone, Young, McKown.
American eel *Anguilla rostrata*	10, 11, 12, 13, 34, 37, 170, 180, 230, 248, 305, 372, 373, 382, 422, 425, 426, 428, 431, 454, 555, 692, 727, 729, 739, 758. Howell, Savoy, Ephart, Gauthier, Monteleone, Young, McKown
Blueback herring *Alosa aestivalis*	10, 11, 12, 13, 34, 37, 173, 180, 211, 248, 287, 305, 350, 372, 373, 382, 422, 425, 426, 428, 431, 461, 464, 556, 557, 558, 727, 739, 741, 758. Howell, Savoy, Ephart, Gauthier, Monteleone, Young, McKown.
Alewife *Alosa pseudoharengus*	10, 11, 12, 13, 34, 37, 173, 211, 248, 287, 305, 308, 372, 373, 382, 422, 425, 426, 428, 431, 460, 464, 557, 558, 727, 739, 741, 758. Howell, Savoy, Ephart, Gauthier, Monteleone, Young, McKown.
American shad *Alosa sapidissima*	10, 11, 12, 13, 34, 37, 125, 126, 169, 180, 211, 248, 287, 305, 334, 335, 372, 373, 382, 367, 422, 425, 426, 428, 431, 460, 596, 597, 720, 727, 739, 741, 758. Howell, Savoy, Ephart, Gauthier, Monteleone, Young, McKown.
Atlantic menhaden *Brevoortia tyrannus*	10, 11, 12, 13, 34, 37, 211, 248, 287, 305, 372, 373, 454, 555, 556, 557, 558, 572, 574, 727, 729, 739, 741, 758. Howell, Savoy, Ephart, Gauthier, Monteleone, Young, McKown.
Atlantic herring *Clupea harengus*	10, 11, 12, 13, 34, 37, 211, 248, 287, 297, 305, 372, 373, 454, 555, 556, 557, 558, 727, 729, 739, 741, 758. Howell, Savoy, Ephart, Gauthier, Monteleone, Young, McKown.
Bay anchovy *Anchoa mitchilli*	10, 11, 12, 13, 34, 37, 180, 188, 211, 248, 287, 304, 305, 422, 425, 426, 428, 431, 454, 459, 555, 556, 557, 558, 566, 729, 739, 741, 758. Howell, Savoy, Gauthier, Monteleone, Young, McKown.
Channel catfish *Ictalurus punctatus*	287. Howell, Savoy, Ephart, Gauthier, Monteleone, Young, McKown.
Rainbow smelt *Osmerus mordax*	10, 11, 12, 13, 34, 70, 248, 305, 372, 373, 382, 422, 425, 426, 428, 431, 727. Howell, Savoy, Ephart, Gauthier, Monteleone, Young, McKown.
Atlantic salmon *Salmo salar*	34, 36, 135, 248, 460, 668, 669, 710. Howell, Savoy, Ephart, Gauthier, Monteleone, Young, McKown.
Atlantic cod *Gadus morhua*	10, 11, 12, 13, 34, 37, 211, 230, 248, 305, 647, 727, 739, 741. Howell, Savoy, Gauthier, Monteleone, Young, McKown.
Haddock *Melanogrammus aeglefinus*	34, 211, 230, 248, 305, 647, 727, 739. Howell, Savoy, Gauthier, Monteleone, Young, McKown.
Atlantic tomcod *Microgadus tomcod*	10, 11, 12, 13, 34, 37, 180, 230, 248, 305, 372, 373, 422, 425, 426, 428, 431, 665, 727, 758. Howell, Savoy, Ephart, Gauthier, Monteleone, Young, McKown.
Pollock *Pollachius virens*	10, 11, 12, 13, 230, 305, 372, 373, 555, 557, 558, 727, 739, 758. Howell, Savoy, Gauthier, Monteleone, Young, McKown.
Red hake *Urophycis chuss*	10, 11, 12, 13, 34, 211, 230, 248, 305, 372, 373, 556, 557, 558, 727, 738, 739, 741, 758. Howell, Savoy, Gauthier, Monteleone, Young, McKown.

Numbers correspond to references listed in Appendix 4, pp. 245-280.
Names correspond to individuals listed in Appendix 3, pp. 239-243.

Species	Long Island Sound, continued
Oyster toadfish *Opsanus tau*	10, 11, 12, 13, 34, 248, 305, 372, 373, 390, 741. Howell, Savoy, Gauthier, Monteleone, Young, McKown.
Sheepshead minnow *Cyprinodon variegatus*	10, 11, 12, 13, 34, 37, 230, 248, 305. Howell, Savoy, Gauthier, Monteleone, Young, McKown.
Killifishes *Fundulus* species	7, 10, 11, 12, 13, 34, 37, 180, 188, 230, 248, 305, 422, 425, 426, 428, 431, 758. Howell, Savoy, Gauthier, Monteleone, Young, McKown.
Silversides *Menidia* species	10, 11, 12, 13, 34, 37, 174, 188, 248, 304, 305, 382, 422, 425, 426, 428, 431, 555-558, 677, 705, 390, 729, 739, 741, 758. Howell, Savoy, Gauthier, Monteleone, Young, McKown.
Northern pipefish *Syngnathus fuscus*	10, 11, 12, 13, 34, 37, 180, 230, 248, 305, 330, 372, 373, 454, 555, 556, 557, 558, 729, 739, 741, 758. Howell, Savoy, Gauthier, Monteleone, Young, McKown.
Northern searobin *Prionotus carolinus*	10, 11, 12, 13, 34, 195, 211, 248, 305, 417, 372, 373, 454, 555, 556, 557, 558, 562, 729, 739, 741, 738, 758. Howell, Savoy, Gauthier, Monteleone, Young, McKown.
White perch *Morone americana*	10, 11, 12, 13, 34, 37, 180, 231, 248, 305, 372, 373, 382, 422, 425, 426, 428, 431, 658, 727, 739, 741, 758. Howell, Savoy, Gauthier, Monteleone, Young, McKown.
Striped bass *Morone saxatilis*	10, 11, 12, 13, 34, 37, 73, 168, 176, 180, 211, 231, 248, 252, 305, 351, 417, 372, 373, 422, 425, 426, 428, 431, 555, 600, 322, 727, 739, 741, 756, 758. Howell, Savoy, Gauthier, Ephart, Monteleone, Young, McKown.
Black sea bass *Centropristis striata*	10, 11, 12, 13, 34, 211, 231, 248, 280, 305, 372, 373, 436, 557, 558, 739, 741. Howell, Savoy, Gauthier, Monteleone, Young, McKown.
Yellow perch *Perca flavescens*	231, 382. Howell, Savoy, Gauthier, Ephart, Monteleone, Young, McKown.
Bluefish *Pomatomus saltatrix*	10, 11, 12, 13, 34, 37, 188, 211, 231, 248, 298, 305, 356, 417, 372, 373, 422, 425, 426, 428, 431, 487, 497, 537, 559, 727, 738, 739, 758. Howell, Savoy, Gauthier, Monteleone, Young, McKown.
Pinfish *Lagodon rhomboides*	285, 465, 739, 741. Howell, Savoy, Gauthier, Monteleone, Young, McKown.
Scup *Stenotomus chrysops*	10-13, 34, 211, 248, 280, 285, 305, 372, 373, 417, 422, 425, 426, 428, 431, 454, 555-558, 457, 727, 729, 738, 739, 741, 758. Howell, Savoy, Gauthier, Monteleone, Young, McKown.
Spotted seatrout *Cynoscion nebulosus*	284, 285, 328. Howell, Savoy, Gauthier, Monteleone, Young, McKown.
Weakfish *Cynoscion regalis*	10, 11, 12, 13, 34, 180, 211, 248, 285, 305, 417, 372, 373, 422, 425, 426, 428, 431, 435, 454, 555, 556, 557, 558, 622, 727, 729, 738, 739, 741, 758. Howell, Savoy, Gauthier, Monteleone, Young, McKown.
Spot *Leiostomus xanthurus*	10, 11, 12, 13, 34, 223, 211, 248, 285, 305, 372, 373, 422, 425, 426, 428, 431, 533, 727, 739, 741. Howell, Savoy, Gauthier, Monteleone, Young, McKown.
Northern kingfish *Menticirrhus saxatilis*	10, 11, 12, 13, 34, 37, 211, 248, 285, 305, 372, 373, 422, 425, 426, 428, 431, 454, 598, 729, 739, 741, 758. Howell, Savoy, Gauthier, Monteleone, Young, McKown.
Atlantic croaker *Micropogonias undulatus*	211, 285, 326, 727, 739, 741. Howell, Savoy, Gauthier, Monteleone, Young, McKown.
Black drum *Pogonias cromis*	34, 248, 285, 671, 741. Howell, Savoy, Gauthier, Monteleone, Young, McKown.
Red drum *Sciaenops ocellatus*	285, 552. Howell, Savoy, Gauthier, Monteleone, Young, McKown.
Mullets *Mugil* species	10, 11, 12, 13, 34, 37, 107, 108, 248, 305, 390, 422, 425, 426, 428, 431, 739, 741. Howell, Savoy, Gauthier, Monteleone, Young, McKown.
Tautog *Tautoga onitis*	10, 11, 12, 13, 19, 34, 37, 195, 248, 304, 305, 372, 373, 417, 454, 555, 557, 558, 727, 729, 739, 741, 758. Howell, Savoy, Gauthier, Monteleone, Young, McKown.
Cunner *Tautogolabrus adspersus*	10, 11, 12, 13, 19, 34, 37, 156, 195, 248, 304, 305, 372, 373, 454, 555, 556, 557, 558, 729, 738, 739, 741, 758. Howell, Savoy, Gauthier, Monteleone, Young, McKown.
American sand lance *Ammodytes americanus*	10, 11, 12, 13, 20, 34, 37, 195, 211, 248, 304, 305, 454, 555, 557, 558, 560, 561, 729, 738, 739, 741, 758. Howell, Savoy, Gauthier, Monteleone, Young, McKown.
Gobies *Gobiosoma* species	10, 11, 12, 13, 37, 50, 136, 195, 305, 422, 425, 426, 428, 431, 557, 558, 621. Howell, Savoy, Gauthier, Monteleone, Young, McKown.
Atlantic mackerel *Scomber scombrus*	10, 11, 12, 13, 34, 195, 211, 248, 305, 372, 373, 417, 454, 555, 727, 739, 741, 758. Howell, Savoy, Gauthier, Monteleone, Young, McKown.
Butterfish *Peprilus triacanthus*	10, 11, 12, 13, 34, 211, 248, 305, 372, 373, 390, 422, 425, 426, 428, 431, 727, 738, 739, 741, 758. Howell, Savoy, Gauthier, Monteleone, Young, McKown.
Summer flounder *Paralichthys dentatus*	10, 11, 12, 13, 34, 49, 210, 248, 280, 305, 372, 373, 211, 558, 573, 390, 422, 425, 426, 428, 431, 727, 738, 739, 741, 758. Howell, Savoy, Gauthier, Monteleone, Young, McKown.
Windowpane flounder *Scophthalmus aquousus*	10, 11, 12, 13, 34, 37, 211, 305, 372, 373, 390, 454, 422, 425, 426, 428, 431, 555, 556, 557, 558, 727, 729, 738, 739, 741, 758. Howell, Savoy, Gauthier, Monteleone, Young, McKown.
Winter flounder *Pleuronectes americanus*	10, 11, 12, 13, 34, 37, 49, 71, 210, 211, 248, 304, 305, 372, 373, 390, 422, 425, 426, 428, 431, 454, 471, 524, 556, 557, 558, 727, 729, 738, 739, 741, 758. Howell, Savoy, Gauthier, Monteleone, Young, McKown.
Hogchoker *Trinectes maculatus*	10, 11, 12, 13, 34, 180, 248, 305, 372, 373, 382, 390, 422, 425, 426, 428, 431, 454, 558, 741. Howell, Savoy, Gauthier, Monteleone, Young, McKown.

Numbers correspond to references listed in Appendix 4, pp. 245-280.

Names correspond to individuals listed in Appendix 3, pp. 239-243.

Appendix 2, continued. Table of references and personal communications

Species	Connecticut River
Blue mussel *Mytilus edulis*	177, 474, 567. Volk.
Bay scallop *Argopecten irradians*	175, 727. Volk.
American oyster *Crassostrea virginica*	76, 211, 613, 660, 661, 727. Volk.
Northern quahog *Mercenaria mercenaria*	167, 211, 657, 659, 666, 727. Volk.
Softshell clam *Mya arenaria*	8, 61, 62, 63, 472, 727. Volk.
Brown shrimp *Peneaus aztecus*	324, 327, 746. Volk.
Daggerblade grass shrimp *Palaemonetes pugio*	14, 188, 746. Volk.
Sevenspine bay shrimp *Crangon septemspinosa*	117, 118, 188, 221, 451, 746. Volk.
American lobster *Homarus americanus*	38, 56, 57, 58, 211, 304, 306, 366, 372, 373, 727, 746. Volk.
Blue crab *Callinectes sapidus*	211, 253, 525, 694, 727, 745, 746. Volk.
Skates *Raja* species	34, 35, 211, 372, 373. Savoy, Ephart, Whitworth.
Atlantic stingray *Dasyatus sabina*	35, Savoy, Ephart, Whitworth.
Cownose ray *Rhinoptera bonansus*	34, 35. Savoy, Ephart, Whitworth.
Shortnose sturgeon *Acipenser brevirostrum*	34, 68, 69, 132, 201, 287, 727. Savoy, Ephart, Whitworth.
Atlantic sturgeon *Acipenser oxyrhynchus*	34, 201, 287, 372, 373, 693, 727. Savoy, Ephart, Whitworth.
American eel *Anguilla rostrata*	34, 37, 170, 180, 230, 276, 372, 373, 381, 383, 454, 555, 692, 727, 729. Savoy, Ephart, Whitworth.
Blueback herring *Alosa aestivalis*	34, 37, 173, 180, 211, 276, 287, 346, 350, 372, 373, 381, 382, 383, 461, 464, 727. Savoy, Ephart, Whitworth.
Alewife *Alosa pseudoharengus*	34, 37, 173, 211, 276, 287, 308, 346, 372, 373, 381, 382, 383, 460, 464, 727. Savoy, Ephart, Whitworth.
American shad *Alosa sapidissima*	34, 37, 125, 126, 169, 180, 211, 276, 287, 334, 335, 372, 373, 381, 382, 383, 380, 367, 460, 596, 597, 720, 727, 751. Savoy, Ephart, Whitworth.
Atlantic menhaden *Brevoortia tyrannus*	34, 37, 211, 276, 287, 372, 373, 381, 383, 454, 555, 572, 574, 727, 729. Savoy, Ephart, Whitworth.
Atlantic herring *Clupea harengus*	34, 37, 211, 287, 297, 372, 373, 381, 383, 454, 555, 727, 729. Savoy, Ephart, Whitworth.
Bay anchovy *Anchoa mitchilli*	34, 37, 180, 188, 211, 287, 304, 381, 454, 459, 555, 566, 729. Savoy, Ephart, Whitworth.
Channel catfish *Ictalurus punctatus*	276, 287, 381. Savoy, Ephart, Whitworth.
Rainbow smelt *Osmerus mordax*	34, 70, 372, 373, 381, 382, 383, 727. Savoy, Ephart, Whitworth.
Atlantic salmon *Salmo salar*	34, 36, 135, 460, 668, 669. Savoy, Ephart, Whitworth.
Atlantic cod *Gadus morhua*	34, 37, 211, 230, 381, 555, 647, 727. Savoy, Ephart, Whitworth.
Haddock *Melanogrammus aeglelinus*	34, 211, 230, 647, 727. Savoy, Ephart, Whitworth.
Atlantic tomcod *Microgadus tomcod*	34, 37, 180, 230, 372, 373, 665, 727. Savoy, Ephart, Whitworth.
Pollock *Pollachius virens*	230, 372, 373, 555, 727. Savoy, Ephart, Whitworth.
Red hake *Urophycis chuss*	34, 211, 230, 372, 373, 727. Savoy, Ephart, Whitworth.

Numbers correspond to references listed in Appendix 4, pp. 245-280.
Names correspond to individuals listed in Appendix 3, pp. 239-243.

Species	Connecticut River, continued
Oyster toadfish *Opsanus tau*	34, 372, 373, 390. Savoy, Ephart, Whitworth.
Sheepshead minnow *Cyprinodon variegatus*	34, 37, 230. Savoy, Ephart, Whitworth.
Killifishes *Fundulus* species	7, 34, 37, 180, 188, 230, 383, 381. Savoy, Ephart, Whitworth.
Silversides *Menidia* species	34, 37, 174, 188, 276, 304, 381, 382, 383, 390, 555, 677, 705, 729. Savoy, Ephart, Whitworth.
Northern pipefish *Syngnathus fuscus*	34, 37, 180, 230, 330, 372, 373, 381, 383, 454, 555, 729. Savoy, Ephart, Whitworth.
Northern searobin *Prionotus carolinus*	34, 195, 211, 372, 373, 454, 555, 729. Savoy, Ephart, Whitworth.
White perch *Morone americana*	34, 37, 180, 231, 276, 372, 373, 381, 382, 658, 727. Savoy, Ephart, Whitworth.
Striped bass *Morone saxatilis*	34, 37, 73, 168, 176, 180, 211, 231, 252, 276, 322, 351, 372, 373, 381, 555, 600, 727. Savoy, Ephart, Whitworth.
Black sea bass *Centropristis striata*	34, 211, 231, 372, 373, 436. Savoy, Ephart, Whitworth.
Yellow perch *Perca flavescens*	231, 276, 381, 382, 383. Savoy, Ephart, Whitworth.
Bluefish *Pomatomus saltatrix*	34, 37, 188, 211, 231, 298, 356, 372, 373, 381, 383, 497, 537, 559, 727. Savoy, Ephart, Whitworth.
Pinfish *Lagodon rhomboides*	285, 465. Savoy, Ephart, Whitworth.
Scup *Stenotomus chrysops*	34, 211, 285, 372, 373, 454, 457, 555, 727, 729. Savoy, Ephart, Whitworth.
Spotted seatrout *Cynoscion nebulosus*	328, 284, 285. Savoy, Ephart, Whitworth.
Weakfish *Cynoscion regalis*	34, 180, 211, 285, 372, 373, 381, 435, 454, 555, 622, 727, 729. Savoy, Ephart, Whitworth.
Spot *Leiostomus xanthurus*	34, 223, 211, 285, 372, 373, 533, 727. Savoy, Ephart, Whitworth.
Northern kingfish *Menticirrhus saxatilis*	34, 37, 211, 285, 372, 373, 454, 729. Savoy, Ephart, Whitworth.
Atlantic croaker *Micropogonias undulatus*	211, 326, 285, 727. Savoy, Ephart, Whitworth.
Black drum *Pogonias cromis*	34, 285, 671. Savoy, Ephart, Whitworth.
Red drum *Sciaenops ocellatus*	285, 552. Savoy, Ephart, Whitworth.
Mullets *Mugil* species	34, 37, 107, 108, 390. Savoy, Ephart, Whitworth.
Tautog *Tautoga onitis*	19, 34, 37, 195, 304, 372, 373, 454, 555, 727, 729. Savoy, Ephart, Whitworth.
Cunner *Tautogolabrus adspersus*	19, 34, 37, 195, 304, 372, 373, 454, 555, 729. Savoy, Ephart, Whitworth.
American sand lance *Ammodytes americanus*	20, 34, 37, 195, 211, 304, 454, 555, 560, 561, 729. Savoy, Ephart, Whitworth.
Gobies *Gobiosoma* species	37, 50, 136, 195, 621. Savoy, Ephart, Whitworth.
Atlantic mackerel *Scomber scombrus*	34, 195, 211, 372, 373, 454, 555, 727. Savoy, Ephart, Whitworth.
Butterfish *Peprilus triacanthus*	34, 211, 372, 373, 390, 727. Savoy, Ephart, Whitworth.
Summer flounder *Paralichthys dentatus*	34, 49, 210, 211, 372, 373, 573, 390, 727. Savoy, Ephart, Whitworth.
Windowpane flounder *Scophthalmus aquousus*	34, 37, 211, 372, 373, 390, 454, 555, 727, 729. Savoy, Ephart, Whitworth.
Winter flounder *Pleuronectes americanus*	34, 37, 49, 71, 210, 211, 304, 372, 373, 390, 454, 471, 727, 729. Savoy, Ephart, Whitworth.
Hogchoker *Trinectes maculatus*	34, 180, 276, 372, 373, 381, 382, 383, 390, 454. Savoy, Ephart, Whitworth.

Numbers correspond to references listed in Appendix 4, pp. 245-280.
Names correspond to individuals listed in Appendix 3, pp. 239-243.

Appendix 2, continued. Table of references and personal communications

Species	Gardiners Bay
Blue mussel *Mytilus edulis*	474, 567. Cerrato, Fox, Briggs, MacKenzie.
Bay scallop *Argopecten irradians*	175, 369. Cerrato, Fox, Briggs, MacKenzie.
American oyster *Crassostrea virginica*	76, 211, 369, 613, 660, 661, 727. Cerrato, Fox, Briggs, MacKenzie.
Northern quahog *Mercenaria mercenaria*	167, 211, 369, 657, 659, 666, 727. Cerrato, Fox, Briggs, MacKenzie.
Softshell clam *Mya arenaria*	8, 61, 62, 63, 369, 472, 727. Cerrato, Fox, Briggs, MacKenzie.
Brown shrimp *Peneaus aztecus*	324, 327, 746. Cerrato, Fox, Briggs, MacKenzie.
Daggerblade grass shrimp *Palaemonetes pugio*	14, 188, 746. Cerrato, Fox, Briggs, MacKenzie.
Sevenspine bay shrimp *Crangon septemspinosa*	117, 118, 188, 221, 451, 746. Cerrato, Fox, Briggs, MacKenzie.
American lobster *Homarus americanus*	211, 272, 366, 372, 373, 632, 738, 746. Cerrato, Fox, Briggs, MacKenzie, Weber.
Blue crab *Callinectes sapidus*	211, 253, 525, 694, 738, 745, 746. Cerrato, Fox, Briggs, MacKenzie, Weber.
Skates *Raja species*	34, 35, 211, 248, 272, 372, 373, 556, 557, 558, 738, 739, 741. Weber.
Atlantic stingray *Dasyatus sabina*	35, 741. Weber.
Cownose ray *Rhinoptera bonansus*	34, 35, 248, 741. Weber.
Shortnose sturgeon *Acipenser brevirostrum*	34, 132, 201, 248, 287, 727. Weber.
Atlantic sturgeon *Acipenser oxyrhynchus*	34, 201, 248, 272, 287, 372, 373, 693, 727, 739, 741. Weber.
American eel *Anguilla rostrata*	34, 37, 170, 230, 248, 272, 372, 373, 420, 427, 454, 553, 555, 692, 727, 729, 739. Weber.
Blueback herring *Alosa aestivalis*	34, 37, 173, 211, 248, 272, 287, 350, 372, 373, 420, 427, 464, 556, 557, 558, 727, 739, 741. Weber.
Alewife *Alosa pseudoharengus*	34, 37, 173, 211, 248, 272, 287, 372, 373, 420, 427, 464, 557, 558, 727, 739, 741. Weber.
American shad *Alosa sapidissima*	34, 37, 169, 211, 248, 272, 287, 367, 372, 373, 420, 427, 597, 720, 727, 739, 741. Weber.
Atlantic menhaden *Brevoortia tyrannus*	34, 37, 178, 211, 248, 272, 287, 372, 373, 454, 553, 555, 556, 557, 558, 572, 574, 727, 729, 739, 741. Ferraro, Weber.
Atlantic herring *Clupea harengus*	34, 37, 211, 248, 272, 287, 297, 372, 373, 454, 553, 555, 556, 557, 558, 727, 729, 739, 741. Ferraro, Weber.
Bay anchovy *Anchoa mitchilli*	34, 37, 178, 188, 211, 248, 287, 420, 427, 454, 459, 555, 556, 557, 558, 566, 729, 739, 741. Ferraro, Weber.
Channel catfish *Ictalurus punctatus*	287. Ferraro, Weber.
Rainbow smelt *Osmerus mordax*	34, 70, 248, 272, 372, 373, 420, 427, 727. Ferraro, Weber.
Atlantic salmon *Salmo salar*	34, 36, 135, 248, 710. Ferraro, Weber.
Atlantic cod *Gadus morhua*	34, 37, 211, 230, 248, 555, 647, 727, 739, 741. Ferraro, Weber.
Haddock *Melanogrammus aeglefinus*	34, 211, 230, 248, 647, 727, 739. Ferraro, Weber.
Atlantic tomcod *Microgadus tomcod*	34, 37, 230, 248, 272, 372, 373, 420, 427, 553, 665, 727. Ferraro, Weber.
Pollock *Pollachius virens*	230, 272, 372, 373, 555, 557, 558, 727, 739. Ferraro, Weber.
Red hake *Urophycis chuss*	34, 211, 230, 248, 272, 372, 373, 556, 557, 558, 727, 738, 739, 741. Ferraro, Weber.

Numbers correspond to references listed in Appendix 4, pp. 245-280.
Names correspond to individuals listed in Appendix 3, pp. 239-243.

Species	Gardiners Bay, continued
Oyster toadfish *Opsanus tau*	34, 248, 272, 372, 373, 390, 741. Ferraro, Weber.
Sheepshead minnow *Cyprinodon variegatus*	34, 37, 230, 248, 553. Ferraro, Weber.
Killifishes *Fundulus species*	7, 34, 37, 188, 230, 248, 420, 427, 553. Ferraro, Weber.
Silversides *Menidia species*	34, 37, 174, 178, 188, 248, 390, 420, 427, 553, 555, 556, 557, 558, 677, 705, 729, 739, 741. Ferraro, Weber.
Northern pipefish *Syngnathus fuscus*	34, 37, 178, 230, 248, 272, 330, 372, 373, 454, 553, 555, 556, 557, 558, 729, 739, 741. Ferraro, Weber.
Northern searobin *Prionotus carolinus*	34, 178, 195, 211, 248, 272, 372, 373, 454, 555, 556, 557, 558, 729, 738, 739, 741. Ferraro, Weber.
White perch *Morone americana*	34, 37, 231, 248, 272, 372, 373, 420, 427, 553, 658, 727, 739, 741. Ferraro, Weber.
Striped bass *Morone saxatilis*	34, 37, 73, 168, 176, 211, 231, 248, 252, 272, 351, 372, 373, 420, 427, 555, 600, 727, 756, 739, 741. Ferraro, Weber.
Black sea bass *Centropristis striata*	34, 211, 231, 248, 272, 280, 372, 373, 436, 557, 558, 739, 741. Ferraro, Weber.
Yellow perch *Perca flavescens*	231, 420, 427. Ferraro, Weber.
Bluefish *Pomatomus saltatrix*	34, 37, 188, 211, 231, 248, 272, 298, 356, 372, 373, 420, 427, 487, 497, 537, 553, 559, 727, 738, 739. Ferraro, Weber.
Pinfish *Lagodon rhomboides*	285, 465, 739, 741. Ferraro, Weber.
Scup *Stenotomus chrysops*	34, 178, 211, 248, 272, 280, 285, 372, 373, 454, 457, 555, 556, 557, 558, 727, 729, 738, 739, 741. Ferraro, Weber.
Spotted seatrout *Cynoscion nebulosus*	328, 284, 285. Ferraro, Weber.
Weakfish *Cynoscion regalis*	34, 178, 211, 248, 272, 285, 372, 373, 420, 427, 435, 454, 555, 556, 557, 558, 622, 727, 729, 738, 739, 741. Ferraro, Weber.
Spot *Leiostomus xanthurus*	34, 223, 211, 247, 248, 272, 285, 372, 373, 420, 427, 533, 727, 739, 741. Ferraro, Weber.
Northern kingfish *Menticirrhus saxatilis*	34, 37, 211, 248, 272, 285, 372, 373, 420, 427, 454, 553, 598, 729, 739, 741. Ferraro, Weber.
Atlantic croaker *Micropogonias undulatus*	211, 326, 285, 727, 739, 741. Ferraro, Weber.
Black drum *Pogonias cromis*	34, 248, 285, 671, 741. Ferraro, Weber.
Red drum *Sciaenops ocellatus*	285, 552. Ferraro, Weber.
Mullets *Mugil species*	34, 37, 107, 108, 248, 390, 420, 427, 553, 739, 741. Ferraro, Weber.
Tautog *Tautoga onitis*	19, 34, 37, 178, 195, 248, 272, 372, 373, 454, 553, 555, 557, 558, 727, 729, 739, 741. Ferraro, Weber.
Cunner *Tautogolabrus adspersus*	19, 34, 37, 178, 195, 248, 272, 372, 373, 454, 553, 555, 556, 557, 558, 729, 738, 739, 741. Ferraro, Weber.
American sand lance *Ammodytes americanus*	20, 34, 37, 178, 195, 211, 248, 454, 553, 555, 557, 558, 560, 561, 729, 738, 739, 741. Ferraro, Weber.
Gobies *Gobiosoma species*	37, 50, 136, 178, 195, 420, 427, 557, 558, 621. Ferraro, Weber.
Atlantic mackerel *Scomber scombrus*	34, 178, 195, 211, 248, 272, 372, 373, 454, 555, 727, 739, 741. Ferraro, Weber.
Butterfish *Peprilus triacanthus*	34, 211, 248, 272, 372, 373, 390, 420, 427, 727, 738, 739, 741. Ferraro, Weber.
Summer flounder *Paralichthys dentatus*	34, 49, 210, 211, 248, 272, 280, 372, 373, 390, 420, 427, 558, 573, 727, 738, 739, 741. Ferraro, Weber.
Windowpane flounder *Scophthalmus aquousus*	34, 37, 178, 211, 272, 372, 373, 390, 420, 427, 454, 555, 556, 557, 558, 727, 729, 738, 739, 741. Ferraro, Weber.
Winter flounder *Pleuronectes americanus*	34, 37, 49, 71, 210, 211, 248, 272, 372, 373, 390, 420, 427, 454, 471, 553, 556, 557, 558, 727, 729, 738, 739, 741. Ferraro, Weber.
Hogchoker *Trinectes maculatus*	34, 178, 248, 272, 372, 373, 390, 420, 427, 454, 558, 741. Ferraro, Weber.

Numbers correspond to references listed in Appendix 4, pp. 245-280.
Names correspond to individuals listed in Appendix 3, pp. 239-243.

Appendix 2, continued. Table of references and personal communications

Species	Great South Bay
Blue mussel *Mytilus edulis*	474, 567, 663. Cerrato, Kassner, MacKenzie, Briggs, Fox.
Bay scallop *Argopecten irradians*	175, 369, 682, 723. Cerrato, Kassner, MacKenzie, Briggs, Fox.
American oyster *Crassostrea virginica*	76, 211, 369, 613, 660, 661, 682, 727. Cerrato, Kassner, MacKenzie, Briggs, Fox.
Northern quahog *Mercenaria mercenaria*	167, 186, 211, 212, 213, 214, 215, 216, 217, 218, 295, 296, 369, 602, 657, 659, 663, 682, 727. Cerrato, Kassner, MacKenzie, Briggs, Fox.
Softshell clam *Mya arenaria*	8, 369, 472, 663, 682, 727. Cerrato, Kassner, MacKenzie, Briggs, Fox.
Brown shrimp *Peneaus aztecus*	324, 327, 682, 746. Cerrato, Briggs, Fox.
Daggerblade grass shrimp *Palaemonetes pugio*	14, 188, 682, 746. Cerrato, Briggs, Fox.
Sevenspine bay shrimp *Crangon septemspinosa*	117, 118, 188, 221, 451, 663, 682, 746. Cerrato, MacKenzie, Briggs, Fox.
American lobster *Homarus americanus*	54, 60, 211, 304, 306, 366, 738, 746. Cerrato, MacKenzie, Briggs, Fox.
Blue crab *Callinectes sapidus*	55, 211, 253, 525, 682, 694, 738, 745, 746. Cerrato, MacKenzie, Briggs, Fox.
Skates *Raja* species	34, 35, 211, 248, 738, 739, 741. Monteleone, Young, McKown, Vecchio, Briggs.
Atlantic stingray *Dasyatus sabina*	35, 741. Monteleone, Young, McKown, Vecchio, Briggs.
Cownose ray *Rhinoptera bonansus*	34, 35, 248, 741. Monteleone, Young, McKown, Vecchio, Briggs.
Shortnose sturgeon *Acipenser brevirostrum*	34, 132, 201, 248, 287, 727. Monteleone, Young, McKown, Vecchio, Briggs.
Atlantic sturgeon *Acipenser oxyrhynchus*	34, 201, 248, 287, 693, 727, 739, 741. Monteleone, Young, McKown, Vecchio, Briggs.
American eel *Anguilla rostrata*	34, 37, 51, 52, 53, 59, 170, 230, 248, 419, 421, 428, 429, 431, 601, 692, 727, 729, 739. Monteleone, Young, McKown, Vecchio, Briggs.
Blueback herring *Alosa aestivalis*	34, 37, 51, 53, 59, 173, 211, 248, 287, 350, 419, 421, 428, 429, 431, 464, 599, 727, 739, 741. Monteleone, Young, McKown, Vecchio, Briggs.
Alewife *Alosa pseudoharengus*	34, 37, 51, 53, 59, 173, 211, 248, 287, 419, 421, 428, 429, 431, 464, 599, 727, 739, 741. Monteleone, Young, McKown, Vecchio, Briggs.
American shad *Alosa sapidissima*	34, 37, 169, 211, 248, 287, 367, 419, 421, 428, 429, 431, 599, 720, 727, 739, 741. Monteleone, Young, McKown, Vecchio, Briggs.
Atlantic menhaden *Brevoortia tyrannus*	34, 37, 51, 53, 59, 211, 248, 287, 452, 453, 572, 574, 599, 601, 727, 729, 739, 741. Monteleone, Young, McKown, Vecchio, Briggs.
Atlantic herring *Clupea harengus*	34, 37, 51, 53, 59, 211, 248, 287, 297, 599, 727, 729, 739, 741. Monteleone, Young, McKown, Vecchio, Briggs.
Bay anchovy *Anchoa mitchilli*	34, 37, 51, 53, 59, 188, 211, 248, 287, 304, 419, 421, 428, 429, 431, 452, 453, 459, 566, 729, 739, 741. Monteleone, Young, McKown, Vecchio, Briggs.
Channel catfish *Ictalurus punctatus*	287. Monteleone, Young, McKown, Vecchio, Briggs.
Rainbow smelt *Osmerus mordax*	34, 70, 248, 419, 421, 428, 429, 431, 727. Monteleone, Young, McKown, Vecchio, Briggs.
Atlantic salmon *Salmo salar*	34, 36, 135, 248. Monteleone, Young, McKown, Vecchio, Briggs.
Atlantic cod *Gadus morhua*	34, 37, 211, 230, 248, 647, 727, 739, 741. Monteleone, Young, McKown, Vecchio, Briggs.
Haddock *Melanogrammus aeglefinus*	34, 211, 230, 248, 647, 727, 739. Monteleone, Young, McKown, Vecchio, Briggs.
Atlantic tomcod *Microgadus tomcod*	34, 37, 51, 53, 59, 230, 248, 419, 421, 428, 429, 431, 665, 727. Monteleone, Young, McKown, Vecchio, Briggs.
Pollock *Pollachius virens*	51, 53, 59, 230, 727, 739. Monteleone, Young, McKown, Vecchio, Briggs.
Red hake *Urophycis chuss*	34, 51, 52, 211, 230, 248, 452, 727, 738, 739, 741. Monteleone, Young, McKown, Vecchio, Briggs.

Numbers correspond to references listed in Appendix 4, pp. 245-280.
Names correspond to individuals listed in Appendix 3, pp. 239-243.

Species	Great South Bay, continued
Oyster toadfish *Opsanus tau*	34, 52, 59, 248, 390, 601, 741. Monteleone, Young, McKown, Vecchio, Briggs.
Sheepshead minnow *Cyprinodon variegatus*	34, 37, 51, 53, 59, 230, 248, 601. Monteleone, Young, McKown, Vecchio, Briggs.
Killifishes *Fundulus* species	7, 34, 37, 51, 53, 59, 188, 230, 248, 419, 421, 428, 429, 431, 452, 453, 601. Monteleone, Young, McKown, Vecchio, Briggs.
Silversides *Menidia* species	34, 37, 51, 53, 59, 174, 188, 248, 304, 390, 419, 421, 428, 429, 431, 452, 453, 601, 677, 705, 729, 739, 741. Monteleone, Young, McKown, Vecchio, Briggs.
Northern pipefish *Syngnathus fuscus*	34, 37, 51, 52, 53, 59, 230, 248, 330, 452, 453, 601, 729, 739, 741. Monteleone, Young, McKown, Vecchio, Briggs.
Northern searobin *Prionotus carolinus*	34, 53, 59, 195, 211, 248, 452, 453, 601, 729, 738, 739, 741. Monteleone, Young, McKown, Vecchio, Briggs.
White perch *Morone americana*	34, 37, 231, 248, 419, 421, 428, 429, 431, 658, 727, 739, 741. Monteleone, Young, McKown, Vecchio, Briggs.
Striped bass *Morone saxatilis*	34, 37, 73, 168, 176, 211, 231, 248, 252, 351, 419, 421, 428, 429, 431, 599, 600, 601, 727, 739, 741, 756. Monteleone, Young, McKown, Vecchio, Briggs.
Black sea bass *Centropristis striata*	34, 51, 52, 59, 211, 231, 248, 280, 436, 601, 739, 741. Monteleone, Young, McKown, Vecchio, Briggs.
Yellow perch *Perca flavescens*	231. Monteleone, Young, McKown, Vecchio, Briggs.
Bluefish *Pomatomus saltatrix*	34, 37, 51, 53, 59, 188, 211, 231, 248, 298, 356, 419, 421, 428, 429, 431, 487, 497, 537, 599, 601, 727, 738, 739. Monteleone, Young, McKown, Vecchio, Briggs.
Pinfish *Lagodon rhomboides*	285, 465, 739, 741. Monteleone, Young, McKown, Vecchio, Briggs.
Scup *Stenotomus chrysops*	34, 52, 53, 59, 211, 248, 280, 285, 419, 421, 428, 429, 431, 457, 601, 727, 729, 738, 739, 741. Monteleone, Young, McKown, Vecchio, Briggs.
Spotted seatrout *Cynoscion nebulosus*	328, 284, 285. Monteleone, Young, McKown, Vecchio, Briggs.
Weakfish *Cynoscion regalis*	34, 53, 211, 248, 285, 435, 419, 421, 428, 429, 431, 452, 453, 601, 622, 727, 729, 738, 739, 741. Monteleone, Young, McKown, Vecchio, Briggs.
Spot *Leiostomus xanthurus*	34, 223, 211, 248, 285, 419, 421, 428, 429, 431, 533, 727, 739, 741. Monteleone, Young, McKown, Vecchio, Briggs.
Northern kingfish *Menticirrhus saxatilis*	34, 37, 51, 52, 53, 59, 211, 248, 285, 419, 421, 428, 429, 431, 452, 598, 599, 601, 729, 739, 741. Monteleone, Young, McKown, Vecchio, Briggs.
Atlantic croaker *Micropogonias undulatus*	211, 326, 285, 727, 739, 741. Monteleone, Young, McKown, Vecchio, Briggs.
Black drum *Pogonias cromis*	34, 248, 285, 671, 741. Monteleone, Young, McKown, Vecchio, Briggs.
Red drum *Sciaenops ocellatus*	285, 552. Monteleone, Young, McKown, Vecchio, Briggs.
Mullets *Mugil* species	34, 37, 51, 53, 59, 107, 108, 248, 390, 419, 421, 428, 429, 431, 599, 601, 739, 741. Monteleone, Young, McKown, Vecchio, Briggs.
Tautog *Tautoga onitis*	19, 34, 37, 51, 52, 53, 59, 195, 248, 304, 452, 453, 601, 727, 729, 739, 741. Monteleone, Young, McKown, Vecchio, Briggs.
Cunner *Tautogolabrus adspersus*	19, 34, 37, 51, 52, 53, 59, 195, 248, 304, 452, 453, 601, 729, 738, 739, 741. Monteleone, Young, McKown, Vecchio, Briggs.
American sand lance *Ammodytes americanus*	20, 34, 37, 51, 53, 59, 195, 211, 248, 304, 452, 453, 560, 561, 729, 738, 739, 741. Monteleone, Young, McKown, Vecchio, Briggs.
Gobies *Gobiosoma* species	37, 50, 136, 195, 419, 421, 428, 429, 431, 452, 453, 621. Monteleone, Young, McKown, Vecchio, Briggs.
Atlantic mackerel *Scomber scombrus*	34, 53, 195, 211, 248, 452, 601, 727, 739, 741. Monteleone, Young, McKown, Vecchio, Briggs.
Butterfish *Peprilus triacanthus*	34, 53, 211, 248, 390, 419, 421, 428, 429, 431, 599, 601, 727, 738, 739, 741. Monteleone, Young, McKown, Vecchio, Briggs.
Summer flounder *Paralichthys dentatus*	34, 49, 210, 211, 248, 280, 573, 390, 419, 421, 428, 429, 431, 601, 727, 738, 739, 741. Monteleone, Young, McKown, Vecchio, Briggs.
Windowpane flounder *Scophthalmus aquousus*	34, 37, 51, 53, 59, 211, 390, 419, 421, 428, 429, 431, 452, 453, 599, 727, 729, 738, 739, 741. Monteleone, Young, McKown, Vecchio, Briggs.
Winter flounder *Pleuronectes americanus*	34, 37, 49, 51, 52, 53, 59, 71, 210, 211, 248, 304, 390, 419, 421, 428, 429, 431, 452, 453, 536, 601, 727, 729, 738, 739, 741. Monteleone, Young, McKown, Vecchio, Briggs.
Hogchoker *Trinectes maculatus*	34, 248, 390, 419, 421, 428, 429, 431, 452, 453, 741. Monteleone, Young, McKown, Vecchio, Briggs.

Numbers correspond to references listed in Appendix 4, pp. 245-280.

Names correspond to individuals listed in Appendix 3, pp. 239-243.

Appendix 2, continued. Table of references and personal communications

Species	Hudson River / Raritan Bay
Blue mussel *Mytilus edulis*	474, 567, 631. MacKenzie, Cerrato, Joseph.
Bay scallop *Argopecten irradians*	175, 369, 370, 727. MacKenzie, Cerrato, Joseph.
American oyster *Crassostrea virginica*	32, 76, 211, 369, 370, 613, 660, 661, 727. MacKenzie, Cerrato, Joseph.
Northern quahog *Mercenaria mercenaria*	32, 167, 211, 369, 370, 657, 659, 727. MacKenzie, Cerrato, Joseph.
Softshell clam *Mya arenaria*	8, 32, 369, 370, 472, 631, 727. MacKenzie, Cerrato, Joseph.
Brown shrimp *Peneaus aztecus*	324, 327, 746. MacKenzie, Cerrato, Byrne.
Daggerblade grass shrimp *Palaemonetes pugio*	14, 85, 188, 746. MacKenzie, Cerrato, Byrne.
Sevenspine bay shrimp *Crangon septemspinosa*	85, 117, 118, 188, 221, 451, 746. MacKenzie, Cerrato, Byrne.
American lobster *Homarus americanus*	111, 211, 366, 370, 727, 738, 746. MacKenzie, Byrne.
Blue crab *Callinectes sapidus*	85, 211, 253, 370, 424, 525, 631, 694, 727, 738, 745, 746. MacKenzie, Byrne, Hattala, Young, McKown.
Skates *Raja* species	32, 34, 35, 211, 738, 739, 741, 742. Hamilton, Pacheco, Finn, MacHaffie, Young, McKown, Byrne.
Atlantic stingray *Dasyatus sabina*	35, 741. Hamilton, Pacheco, Finn, MacHaffie, Young, McKown, Byrne.
Cownose ray *Rhinoptera bonansus*	34, 35, 85, 741. Hamilton, Pacheco, Finn, MacHaffie, Young, McKown, Byrne.
Shortnose sturgeon *Acipenser brevirostrum*	32, 34, 132, 147, 201, 227, 228, 229, 234, 287, 370, 631, 727, 742. Hamilton, Hattala, Pacheco, Finn, MacHaffie, Young, McKown, Byrne.
Atlantic sturgeon *Acipenser oxyrhynchus*	32, 34, 147, 201, 227, 228, 229, 234, 287, 631, 693, 727, 739, 741, 742. Hamilton, Hattala, Pacheco, Finn, MacHaffie, Young, McKown, Byrne.
American eel *Anguilla rostrata*	32, 34, 85, 154, 170, 180, 227, 228, 229, 230, 234, 362, 370, 423, 424, 430, 522, 631, 692, 727, 729, 739, 742. Hamilton, Hattala, Pacheco, Finn, MacHaffie, Young, McKown, Byrne.
Blueback herring *Alosa aestivalis*	32, 34, 85, 147, 154, 173, 180, 211, 227, 228, 229, 234, 287, 291, 362, 370, 423, 424, 430, 464, 522, 631, 727, 739, 741, 742. Hamilton, Hattala, Pacheco, Finn, MacHaffie, Young, McKown, Byrne.
Alewife *Alosa pseudoharengus*	32, 34, 85, 111, 147, 154, 173, 211, 227, 228, 229, 234, 287, 362, 370, 423, 424, 430, 464, 522, 631, 727, 739, 741, 742. Hattala, Pacheco, Finn, MacHaffie, Young, McKown, Byrne.
American shad *Alosa sapidissima*	32, 34, 85, 111, 147, 154, 169, 180, 211, 227, 228, 229, 234, 287, 291, 362, 370, 367, 423, 430, 424, 522, 631, 720, 727, 739, 741, 742. Hamilton, Hattala, Pacheco, Finn, MacHaffie, Young, McKown, Byrne.
Atlantic menhaden *Brevoortia tyrannus*	32, 34, 85, 154, 211, 227, 228, 229, 234, 287, 362, 370, 424, 572, 574, 631, 727, 729, 739, 741, 742. Hamilton, Hattala, Pacheco, Finn, MacHattie, Young, McKown, Byrne.
Atlantic herring *Clupea harengus*	32, 34, 85, 154, 211, 229, 287, 297, 362, 424, 631, 727, 729, 739, 741. Hamilton, Pacheco, Finn, MacHaffie, Young, McKown, Byrne.
Bay anchovy *Anchoa mitchilli*	32, 34, 85, 111, 154, 180, 188, 211, 227, 228, 229, 234, 287, 291, 362, 423, 424, 430, 459, 522, 566, 631, 729, 739, 741, 742. Hamilton, Hattala, Pacheco, Finn, MacHaffie, Young, McKown, Byrne.
Channel catfish *Ictalurus punctatus*	227, 228, 287. Hamilton, Hattala, Pacheco, Finn, MacHaffie, Young, McKown, Byrne.
Rainbow smelt *Osmerus mordax*	32, 34, 70, 154, 227, 228, 229, 234, 423, 430, 727. Hamilton, Pacheco, Finn, MacHaffie, Young, McKown, Byrne.
Atlantic salmon *Salmo salar*	34, 36, 135, 710. Hamilton, Hattala, Pacheco, Finn, MacHaffie, Young, McKown, Byrne.
Atlantic cod *Gadus morhua*	34, 154, 211, 229, 230, 647, 727, 739, 741. Hamilton, Pacheco, Finn, MacHaffie, Young, McKown, Byrne.
Haddock *Melanogrammus aeglefinus*	34, 211, 230, 647, 727, 739. Hamilton, Pacheco, Finn, MacHaffie, Young, McKown, Byrne.
Atlantic tomcod *Microgadus tomcod*	32, 34, 85, 146, 154, 400, 180, 227, 228, 229, 230, 234, 291, 362, 423, 424, 430, 522, 631, 665, 727. Hamilton, Hattala, Pacheco, Finn, MacHaffie, Young, McKown, Byrne, Dunning.
Pollock *Pollachius virens*	32, 85, 230, 424, 727, 739. Pacheco, Finn, MacHaffie, Young, McKown, Byrne.
Red hake *Urophycis chuss*	32, 34, 111, 211, 227, 228, 229, 230, 234, 362, 424, 727, 738, 739, 741, 742. Hamilton, Pacheco, Finn, MacHaffie, Young, McKown, Byrne.

Numbers correspond to references listed in Appendix 4, pp. 245-280.
Names correspond to individuals listed in Appendix 3, pp. 239-243.

Species	Hudson River / Raritan Bay, continued
Oyster toadfish *Opsanus tau*	32, 34, 154, 362, 390, 424, 741, 742. Pacheco, Finn, MacHaffie, Young, McKown, Byrne.
Sheepshead minnow *Cyprinodon variegatus*	34, 85, 230, 362. Pacheco, Finn, MacHaffie, Byrne.
Killifishes *Fundulus* species	7, 32, 34, 85, 180, 188, 227, 228, 229, 230, 234, 362, 423, 424, 430, 522, 631. Hamilton, Hattala, Pacheco, Finn, MacHaffie, Young, McKown, Byrne.
Silversides *Menidia* species	32, 34, 85, 154, 174, 188, 227, 228, 229, 234, 362, 390, 423, 424, 430, 522, 631, 677, 705, 729, 739, 741, 742. Pacheco, Finn, MacHaffie, Young, McKown, Byrne.
Northern pipefish *Syngnathus fuscus*	32, 34, 85, 154, 180, 227, 228, 229, 230, 234, 330, 362, 424, 522, 729, 739, 741. Hamilton, Pacheco, Finn, MacHaffie, Young, McKown, Byrne.
Northern searobin *Prionotus carolinus*	32, 34, 195, 211, 227, 228, 229, 362, 424, 729, 738, 739, 741, 742. Pacheco, Finn, MacHaffie, Byrne.
White perch *Morone americana*	28, 32, 34, 85, 154, 180, 227, 228, 229, 231, 234, 291, 362, 423, 424, 430, 522, 631, 658, 727, 739, 741. Hamilton, Pacheco, Finn, MacHaffie, Young, McKown, Byrne.
Striped bass *Morone saxatilis*	32, 34, 73, 85, 147, 154, 168, 176, 180, 197, 211, 229, 231, 234, 252, 291, 351, 362, 370, 423, 424, 430, 522, 600, 631, 701, 727, 739, 741, 756. Hamilton, Hattala, Pacheco, Finn, MacHaffie, Young, McKown, Byrne, Dunning.
Black sea bass *Centropristis striata*	32, 34, 211, 228, 231, 436, 739, 741. Hamilton, Pacheco, Finn, MacHaffie, Young, McKown, Byrne.
Yellow perch *Perca flavescens*	32, 154, 227, 229, 231, 234, 423, 430, 631. Hamilton, Pacheco, Finn, MacHaffie, Young, McKown, Byrne.
Bluefish *Pomatomus saltatrix*	32, 34, 85, 154, 188, 211, 227, 228, 229, 231, 234, 291, 298, 356, 362, 370, 423, 424, 430, 487, 497, 522, 537, 631, 727, 742, 738, 739. Hamilton, Hattala, Pacheco, Finn, MacHaffie, Young, McKown, Byrne.
Pinfish *Lagodon rhomboides*	285, 465, 739, 741. Pacheco, Finn, MacHaffie, Young, McKown, Byrne.
Scup *Stenotomus chrysops*	32, 34, 111, 211, 228, 234, 285, 362, 370, 424, 457, 727, 729, 738, 739, 741, 742. Pacheco, Finn, MacHaffie, Young, McKown, Byrne.
Spotted seatrout *Cynoscion nebulosus*	284, 285, 328. Pacheco, Finn, MacHaffie, Young, McKown, Byrne.
Weakfish *Cynoscion regalis*	32, 34, 111, 154, 180, 211, 227, 228, 229, 234, 285, 362, 370, 423, 424, 430, 435, 622, 631, 727, 729, 738, 739, 741, 742. Pacheco, Finn, MacHaffie, Young, McKown, Byrne.
Spot *Leiostomus xanthurus*	32, 34, 85, 154, 211, 223, 227, 228, 229, 234, 285, 362, 370, 423, 424, 430, 533, 727, 739, 741. Hamilton, Pacheco, Finn, MacHaffie, Young, McKown, Byrne.
Northern kingfish *Menticirrhus saxatilis*	32, 34, 85, 211, 227, 228, 229, 285, 362, 370, 423, 424, 430, 729, 739, 741, 742. Hamilton, Pacheco, Finn, MacHaffie, Young, McKown, Byrne.
Atlantic croaker *Micropogonias undulatus*	32, 154, 211, 227, 228, 229, 326, 285, 362, 370, 727, 739, 741. Hamilton, Pacheco, Finn, MacHaffie, Young, McKown, Byrne.
Black drum *Pogonias cromis*	34, 234, 285, 362, 671, 741. Hamilton, Pacheco, Finn, MacHaffie, Young, McKown, Byrne.
Red drum *Sciaenops ocellatus*	154, 285, 552. Hamilton, Pacheco, Finn, MacHaffie, Young, McKown, Byrne.
Mullets *Mugil* species	32, 34, 85, 107, 108, 227, 228, 362, 370, 390, 423, 424, 430, 739, 741. Hamilton, Pacheco, Finn, MacHaffie, Young, McKown, Byrne.
Tautog *Tautoga onitis*	19, 32, 34, 85, 154, 195, 227, 229, 234, 362, 370, 424, 727, 729, 739, 741, 742. Hamilton, Pacheco, Finn, MacHaffie, Young, McKown, Byrne.
Cunner *Tautogolabrus adspersus*	19, 32, 34, 154, 195, 227, 228, 229, 362, 370, 424, 729, 738, 739, 741. Hamilton, Pacheco, Finn, MacHaffie, Young, McKown, Byrne.
American sand lance *Ammodytes americanus*	20, 32, 34, 85, 195, 211, 229, 362, 424, 560, 561, 729, 738, 739, 741. Hamilton, Pacheco, Finn, MacHaffie, Young, McKown, Byrne.
Gobies *Gobiosoma* species	32, 50, 85, 136, 154, 195, 227, 228, 229, 362, 423, 424, 430, 621. Hamilton, Pacheco, Finn, MacHaffie, Young, McKown, Byrne.
Atlantic mackerel *Scomber scombrus*	34, 195, 211, 229, 424, 631, 727, 739, 741. Hamilton, Pacheco, Finn, MacHaffie, Young, McKown, Byrne.
Butterfish *Peprilus triacanthus*	32, 34, 111, 154, 211, 227, 228, 229, 234, 362, 370, 390, 423, 430, 727, 738, 739, 741, 742. Hamilton, Pacheco, Finn, MacHaffie, Young, McKown, Byrne.
Summer flounder *Paralichthys dentatus*	32, 34, 49, 85, 111, 154, 210, 211, 227, 228, 229, 362, 370, 423, 424, 430, 573, 390, 631, 727, 738, 739, 741, 742. Hattala, Pacheco, Finn, MacHaffie, Young, McKown, Byrne.
Windowpane flounder *Scophthalmus aquousus*	32, 34, 85, 111, 154, 211, 227, 228, 229, 362, 390, 423, 424, 430, 727, 729, 741, 742, 738, 739. Pacheco, Finn, MacHaffie, Byrne.
Winter flounder *Pleuronectes americanus*	32, 34, 49, 71, 85, 111, 154, 210, 211, 227, 228, 229, 234, 362, 370, 390, 423, 424, 430, 531, 631, 727, 729, 738, 739, 741, 742. Hattala, Pacheco, Finn, MacHaffie, Young, McKown, Byrne.
Hogchoker *Trinectes maculatus*	32, 34, 154, 180, 227, 228, 229, 234, 362, 390, 423, 424, 430, 522, 741. Hamilton, Hattala, Pacheco, Finn, MacHaffie, Young, McKown, Byrne.

Numbers correspond to references listed in Appendix 4, pp. 245-280.
Names correspond to individuals listed in Appendix 3, pp. 239-243.

Appendix 2, continued. Table of references and personal communications

Species	Barnegat Bay
Blue mussel *Mytilus edulis*	302, 450, 474. MacKenzie, Browne, Vouglitois, Pacheco, Finn, Byrne, Mountford.
Bay scallop *Argopecten irradians*	175, 374, 450, 532. MacKenzie, Browne, Vouglitois, Pacheco, Finn, Byrne, Mountford.
American oyster *Crassostrea virginica*	302, 450, 532, 661. MacKenzie, Pacheco, Finn, Figley, Byrne, Mountford.
Northern quahog *Mercenaria mercenaria*	290, 302, 408, 571, 657. MacKenzie, Browne, Vouglitois, Pacheco, Finn, Byrne, Mountford.
Softshell clam *Mya arenaria*	8, 302. MacKenzie, Browne, Vouglitois, Pacheco, Finn, Byrne, Mountford.
Brown shrimp *Peneaus aztecus*	102, 324, 332, 746. Browne, Vouglitois, Pacheco, Finn, Byrne, Mountford.
Daggerblade grass shrimp *Palaemonetes pugio*	14, 450, 746. Browne, Vouglitois, Pacheco, Finn, Mountford.
Sevenspine bay shrimp *Crangon septemspinosa*	302, 545, 675, 746. Browne, Vouglitois, Pacheco, Finn, Byrne, Mountford.
American lobster *Homarus americanus*	302, 366, 374, 674, 746. MacKenzie, Browne, Vouglitois, Pacheco, Finn, Figley, Byrne, Mountford.
Blue crab *Callinectes sapidus*	253, 301, 302, 571, 674, 745, 746. Browne, Vouglitois, Pacheco, Finn, Figley, Mountford.
Skates *Raja* species	34, 35, 302, 450. Browne, Vouglitois, Pacheco, Finn, Figley, Byrne, Mountford.
Atlantic stingray *Dasyatus sabina*	35. Browne, Vouglitois, Pacheco, Finn, Byrne, Mountford.
Cownose ray *Rhinoptera bonansus*	34, 35, 637. Browne, Vouglitois, Pacheco, Finn, Byrne.
Shortnose sturgeon *Acipenser brevirostrum*	34, 132, 201, 302, 405, 577, 674. Browne, Vouglitois, Pacheco, Finn, Byrne, Mountford.
Atlantic sturgeon *Acipenser oxyrhynchus*	3, 9, 34, 201, 232, 287, 302, 449, 577. Browne, Vouglitois, Pacheco, Finn, Byrne, Mountford.
American eel *Anguilla rostrata*	34, 170, 302, 411, 571, 650, 672, 673, 699. Browne, Vouglitois, Pacheco, Finn, Figley, Byrne, Fahay, Mountford.
Blueback herring *Alosa aestivalis*	34, 83, 287, 405, 464, 759. Browne, Vouglitois, Pacheco, Finn, Byrne, Mountford.
Alewife *Alosa pseudoharengus*	34, 83, 173, 287, 302, 464, 759. Browne, Vouglitois, Pacheco, Finn, Byrne, Mountford.
American shad *Alosa sapidissima*	34, 83, 287, 302, 367, 759. Browne, Vouglitois, Pacheco, Finn, Byrne, Mountford.
Atlantic menhaden *Brevoortia tyrannus*	34, 287, 302, 411, 574, 699. Browne, Vouglitois, Pacheco, Finn, Figley, Byrne, Fahay, Mountford.
Atlantic herring *Clupea harengus*	9, 34, 255, 287, 297, 302, 411, 699. Browne, Vouglitois, Pacheco, Finn, Byrne, Mountford.
Bay anchovy *Anchoa mitchilli*	34, 287, 302, 459, 571, 699, 700. Browne, Vouglitois, Pacheco, Finn, Byrne, Mountford.
Channel catfish *Ictalurus punctatus*	9, 232, 287, 302. Browne, Vouglitois, Pacheco, Finn, Byrne, Mountford.
Rainbow smelt *Osmerus mordax*	34, 70, 302, 674. Browne, Vouglitois, Pacheco, Finn, Byrne, Mountford.
Atlantic salmon *Salmo salar*	34, 36, 135, 302, 405, 450, 674. Browne, Vouglitois, Pacheco, Finn, Figley, Byrne, Mountford.
Atlantic cod *Gadus morhua*	9, 34, 230, 232, 302, 577, 647. Browne, Vouglitois, Pacheco, Finn, Figley, Byrne, Mountford.
Haddock *Melanogrammus aeglefinus*	9, 34, 230, 232, 302, 647, 699. Browne, Vouglitois, Pacheco, Finn, Figley, Byrne, Mountford.
Atlantic tomcod *Microgadus tomcod*	3, 9, 34, 230, 302, 450, 577, 665, [illegible]. Browne, Vouglitois, Pacheco, Finn, Figley, Byrne, Mountford.
Pollock *Pollachius virens*	3, 9, 230, 302, 411, 577, 699. Browne, Vouglitois, Pacheco, Finn, Figley, Byrne, Fahay, Mountford.
Red hake *Urophycis chuss*	9, 34, 230, 302, 411, 664, 699. Browne, Vouglitois, Pacheco, Finn, Byrne, Fahay, Mountford.

Numbers correspond to references listed in Appendix 4, pp. 245-280.
Names correspond to individuals listed in Appendix 3, pp. 239-243.

Species	Barnegat Bay, continued
Oyster toadfish *Opsanus tau*	9, 34, 219, 302, 341, 390, 577. Browne, Vouglitois, Pacheco, Fine, Finn, Figley, Byrne, Mountford.
Sheepshead minnow *Cyprinodon variegatus*	9, 34, 230, 302, 550, 672. Browne, Vouglitois, Pacheco, Finn, Figley, Byrne, Mountford.
Killifishes *Fundulus* species	5, 6, 7, 9, 34, 230, 302, 550, 672. Browne, Vouglitois, Pacheco, Finn, Figley, Byrne, Mountford.
Silversides *Menidia* species	9, 34, 174, 302, 550, 571, 699. Browne, Vouglitois, Pacheco, Finn, Figley, Byrne, Mountford.
Northern pipefish *Syngnathus fuscus*	9, 302, 699, 230, 330. Browne, Vouglitois, Pacheco, Finn, Figley, Byrne, Fahay, Mountford.
Northern searobin *Prionotus carolinus*	34, 35, 195, 255, 302, 411, 577. Browne, Vouglitois, Pacheco, Finn, Figley, Byrne, Fahay, Mountford.
White perch *Morone americana*	9, 231, 232, 302, 571, 577, 658, 699. Browne, Vouglitois, Pacheco, Finn, Figley, Byrne, Mountford.
Striped bass *Morone saxatilis*	9, 176, 231, 232, 302, 577. Browne, Vouglitois, Pacheco, Finn, Figley, Byrne, Mountford.
Black sea bass *Centropristis striata*	231, 302, 411, 436, 469, 577. Browne, Vouglitois, Pacheco, Finn, Figley, Byrne, Mountford.
Yellow perch *Perca flavescens*	231, 232, 341, 550. Browne, Vouglitois, Pacheco, Finn, Byrne, Mountford.
Bluefish *Pomatomus saltatrix*	3, 9, 231, 232, 298, 302, 411, 537, 577. Browne, Vouglitois, Pacheco, Finn, Figley, Byrne, Fahay, Mountford.
Pinfish *Lagodon rhomboides*	3, 232, 285, 302, 449, 465, 577. Browne, Vouglitois, Pacheco, Finn, Figley, Byrne, Fahay, Mountford.
Scup *Stenotomus chrysops*	3, 9, 34, 285, 302, 699. Browne, Vouglitois, Pacheco, Finn, Figley, Byrne, Fahay, Mountford.
Spotted seatrout *Cynoscion nebulosus*	3, 9, 284, 285, 302, 699. Browne, Vouglitois, Pacheco, Finn, Byrne, Mountford.
Weakfish *Cynoscion regalis*	9, 232, 285, 302, 411, 435, 577, 699. Browne, Vouglitois, Pacheco, Finn, Figley, Byrne, Mountford.
Spot *Leiostomus xanthurus*	9, 232, 285, 302, 450, 533, 571, 577, 699. Browne, Vouglitois, Pacheco, Finn, Byrne, Fahay, Mountford.
Northern kingfish *Menticirrhus saxatilis*	9, 255, 285, 302, 411, 450, 699. Browne, Vouglitois, Pacheco, Finn, Byrne, Fahay, Mountford.
Atlantic croaker *Micropogonias undulatus*	9, 232, 285, 302, 411, 699. Browne, Vouglitois, Pacheco, Finn, Byrne, Mountford.
Black drum *Pogonias cromis*	3, 285, 577, 671, 699. Browne, Vouglitois, Pacheco, Finn, Figley, Byrne, Mountford.
Red drum *Sciaenops ocellatus*	3, 9, 302, 285, 552, 699. Browne, Vouglitois, Pacheco, Finn, Byrne, Mountford.
Mullets *Mugil* species	107, 108, 390. Browne, Vouglitois, Pacheco, Finn, Figley, Byrne, Mountford.
Tautog *Tautoga onitis*	9, 19, 195, 302, 411, 577, 699. Browne, Vouglitois, Pacheco, Finn, Figley, Byrne, Mountford.
Cunner *Tautogolabrus adspersus*	9, 19, 195, 302, 411. Browne, Vouglitois, Pacheco, Finn, Figley, Byrne, Mountford.
American sand lance *Ammodytes americanus*	9, 20, 195, 302. Browne, Vouglitois, Pacheco, Finn, Byrne, Fahay, Mountford.
Gobies *Gobiosoma* species	9, 136, 232, 302, 577. Browne, Vouglitois, Pacheco, Finn, Byrne, Mountford.
Atlantic mackerel *Scomber scombrus*	3, 9, 195, 302, 411. Browne, Vouglitois, Pacheco, Finn, Figley, Mountford.
Butterfish *Peprilus triacanthus*	9, 34, 302, 390, 411. Browne, Vouglitois, Pacheco, Finn, Byrne, Mountford.
Summer flounder *Paralichthys dentatus*	9, 210, 255, 302, 390, 411, 573, 699. Browne, Vouglitois, Pacheco, Finn, Figley, Byrne, Fahay, Mountford.
Windowpane flounder *Scophthalmus aquousus*	9, 302, 390, 411, 577, 699. Browne, Vouglitois, Pacheco, Finn, Figley, Byrne, Fahay, Mountford.
Winter flounder *Pleuronectes americanus*	9, 71, 210, 232, 302, 390, 411, 571, 699. Browne, Vouglitois, Pacheco, Finn, Figley, Byrne, Fahay, Mountford.
Hogchoker *Trinectes maculatus*	9, 232, 302, 390. Browne, Vouglitois, Pacheco, Finn, Byrne, Fahay, Mountford.

Numbers correspond to references listed in Appendix 4, pp. 245-280.
Names correspond to individuals listed in Appendix 3, pp. 239-243.

Appendix 2, continued. Table of references and personal communications

Species	New Jersey Inland Bays
Blue mussel *Mytilus edulis*	175, 374, 450, 474, 532. MacKenzie, Byrne, Figley, Mountford.
Bay scallop *Argopecten irradians*	175, 374, 450, 532. MacKenzie, Pacheco, Finn, Byrne, Figley, Mountford.
American oyster *Crassostrea virginica*	374, 661. MacKenzie, Byrne, Figley.
Northern quahog *Mercenaria mercenaria*	290, 302, 408, 407, 657. MacKenzie, Figley, Byrne.
Softshell clam *Mya arenaria*	8, 374. MacKenzie, Figley, Byrne.
Brown shrimp *Peneaus aztecus*	102, 324, 332, 746. Pacheco, Finn, Byrne.
Daggerblade grass shrimp *Palaemonetes pugio*	14, 450, 746. Pacheco, Finn, Byrne.
Sevenspine bay shrimp *Crangon septemspinosa*	302, 545, 675, 746. Pacheco, Finn, Byrne.
American lobster *Homarus americanus*	366, 406, 450, 650, 746. MacKenzie, Pacheco, Finn, Byrne.
Blue crab *Callinectes sapidus*	253, 301, 302, 674, 745, 746. Pacheco, Finn, Figley, Byrne.
Skates *Raja* species	34, 35, 302, 450. Pacheco, Finn, Figley, Byrne, Mountford.
Atlantic stingray *Dasyatus sabina*	35. Pacheco, Finn, Byrne.
Cownose ray *Rhinoptera bonansus*	34, 35, 637. Pacheco, Finn, Byrne, Mountford.
Shortnose sturgeon *Acipenser brevirostrum*	34, 132, 201, 302, 405, 577, 674. Pacheco, Finn, Byrne.
Atlantic sturgeon *Acipenser oxyrhynchus*	3, 9, 34, 201, 232, 287, 302, 449, 577. Pacheco, Finn, Byrne.
American eel *Anguilla rostrata*	9, 34, 170, 577, 673. Pacheco, Finn, Figley, Byrne, Fahay.
Blueback herring *Alosa aestivalis*	9, 34, 83, 232, 287, 406, 450, 464, 759. Pacheco, Finn, Byrne.
Alewife *Alosa pseudoharengus*	9, 34, 83, 173, 287, 464, 759. Pacheco, Finn, Byrne.
American shad *Alosa sapidissima*	9, 34, 83, 232, 287, 367, 406, 450. Pacheco, Finn, Byrne.
Atlantic menhaden *Brevoortia tyrannus*	9, 34, 287, 574, 577. Pacheco, Finn, Byrne, Fahay.
Atlantic herring *Clupea harengus*	9, 34, 287, 297, 302, 411. Pacheco, Finn, Byrne.
Bay anchovy *Anchoa mitchilli*	9, 34, 287, 302, 459, 699, 700. Browne, Vouglitois, Pacheco, Finn, Byrne.
Channel catfish *Ictalurus punctatus*	9, 232, 287, 302. Pacheco, Finn, Byrne.
Rainbow smelt *Osmerus mordax*	34, 70, 450, 577. Pacheco, Finn, Byrne.
Atlantic salmon *Salmo salar*	34, 36, 135, 406, 450, 577. Pacheco, Finn, Figley, Byrne.
Atlantic cod *Gadus morhua*	9, 34, 230, 232, 302, 577, 647. Pacheco, Finn, Figley, Byrne.
Haddock *Melanogrammus aeglefinus*	9, 34, 230, 232, 302, 647, 699. Pacheco, Finn, Figley, Byrne.
Atlantic tomcod *Microgadus tomcod*	3, 9, 34, 230, 302, 450, 577, 665, 699. Pacheco, Finn, Figley, Byrne.
Pollock *Pollachius virens*	3, 9, 230, 302, 411, 577, 699. Pacheco, Finn, Figley, Byrne, Fahay.
Red hake *Urophycis chuss*	9, 34, 230, 302, 411, 664, 699. Pacheco, Finn, Figley, Byrne, Fahay.

Numbers correspond to references listed in Appendix 4, pp. 245-280.
Names correspond to individuals listed in Appendix 3, pp. 239-243.

Species	New Jersey Inland Bays, continued
Oyster toadfish *Opsanus tau*	9, 34, 219, 302, 341, 390, 577. Pacheco, Fine, Finn, Figley, Byrne.
Sheepshead minnow *Cyprinodon variegatus*	9, 34, 230, 302, 550, 672. Pacheco, Finn, Figley, Byrne.
Killifishes *Fundulus* species	5, 6, 7, 9, 34, 230, 302, 550, 672. Pacheco, Finn, Figley, Byrne.
Silversides *Menidia* species	9, 34, 174, 302, 550, 672. Pacheco, Finn, Figley, Byrne.
Northern pipefish *Syngnathus fuscus*	9, 230, 302, 330, 699. Pacheco, Finn, Figley, Byrne.
Northern searobin *Prionotus carolinus*	9, 34, 35, 195, 255, 302, 411, 577. Pacheco, Finn, Figley, Byrne, Fahay.
White perch *Morone americana*	9, 231, 255, 302, 577, 658, 699. Pacheco, Finn, Figley, Byrne.
Striped bass *Morone saxatilis*	9, 176, 231, 232, 302, 577. Pacheco, Finn, Figley, Byrne.
Black sea bass *Centropristis striata*	231, 302, 411, 436, 577, 469. Pacheco, Finn, Figley, Byrne, Fahay.
Yellow perch *Perca flavescens*	231, 232, 341, 550. Pacheco, Finn, Byrne.
Bluefish *Pomatomus saltatrix*	3, 9, 231, 232, 298, 302, 411, 537, 577. Pacheco, Finn, Figley, Byrne, Fahay.
Pinfish *Lagodon rhomboides*	3, 9, 232, 285, 302, 449, 465, 577. Pacheco, Finn, Byrne, Fahay.
Scup *Stenotomus chrysops*	3, 9, 34, 285, 302, 699. Pacheco, Finn, Byrne.
Spotted seatrout *Cynoscion nebulosus*	3, 9, 284, 285, 302, 699. Pacheco, Finn, Byrne.
Weakfish *Cynoscion regalis*	9, 232, 285, 302, 411, 435, 577, 699. Pacheco, Finn, Byrne.
Spot *Leiostomus xanthurus*	9, 232, 285, 302, 450, 533, 577, 699. Pacheco, Finn, Byrne, Fahay.
Northern kingfish *Menticirrhus saxatilis*	9, 255, 285, 302, 411, 450, 699. Pacheco, Finn, Byrne, Fahay.
Atlantic croaker *Micropogonias undulatus*	9, 232, 285, 302, 411, 699. Pacheco, Finn, Byrne.
Black drum *Pogonias cromis*	3, 9, 285, 302, 577, 671, 699. Pacheco, Finn, Figley, Byrne, Vouglitois.
Red drum *Sciaenops ocellatus*	3, 9, 285, 302, 552, 699. Pacheco, Finn, Byrne.
Mullets *Mugil* species	107, 108, 390. Pacheco, Finn, Figley, Byrne.
Tautog *Tautoga onitis*	9, 19, 195, 302, 411, 577, 651, 699. Pacheco, Finn, Figley, Byrne.
Cunner *Tautogolabrus adspersus*	9, 19, 195, 302, 411. Pacheco, Finn, Figley, Byrne.
American sand lance *Ammodytes americanus*	9, 20, 195, 302. Pacheco, Finn, Byrne.
Gobies *Gobiosoma* species	9, 136, 232, 302, 577. Pacheco, Finn, Byrne.
Atlantic mackerel *Scomber scombrus*	3, 9, 195, 302, 411. Pacheco, Finn, Figley, Byrne.
Butterfish *Peprilus triacanthus*	9, 34, 302, 390, 411. Pacheco, Finn, Byrne.
Summer flounder *Paralichthys dentatus*	9, 210, 255, 302, 390, 411, 573, 578, 699. Pacheco, Finn, Figley, Byrne, Fahay.
Windowpane flounder *Scophthalmus aquousus*	9, 302, 390, 411, 577, 699. Pacheco, Finn, Figley, Byrne, Fahay.
Winter flounder *Pleuronectes americanus*	9, 71, 210, 232, 302, 390, 411, 699. Pacheco, Finn, Figley, Byrne, Fahay.
Hogchoker *Trinectes maculatus*	9, 232, 302, 390. Pacheco, Finn, Byrne, Fahay.

Numbers correspond to references listed in Appendix 4, pp. 245-280.
Names correspond to individuals listed in Appendix 3, pp. 239-243.

Appendix 2, continued. Table of references and personal communications

Species	Delaware Bay
Blue mussel *Mytilus edulis*	192, 270, 401, 474. Steimle, Kraueter.
Bay scallop *Argopecten irradians*	175, 192, 401, 416, 727. Kraueter.
American oyster *Crassostrea virginica*	192, 401, 564, 613, 661, 727. Kraueter.
Northern quahog *Mercenaria mercenaria*	8, 192, 401, 416, 657, 727. Kraueter.
Softshell clam *Mya arenaria*	8, 401, 727. Kraueter.
Brown shrimp *Peneaus aztecus*	102, 324, 332, 746. Halgren.
Daggerblade grass shrimp *Palaemonetes pugio*	14, 332, 746. Halgren.
Sevenspine bay shrimp *Crangon septemspinosa*	545, 746. Halgren.
American lobster *Homarus americanus*	192, 332, 366, 727, 746. Halgren.
Blue crab *Callinectes sapidus*	150, 165, 192, 253, 727, 745, 746. Epifanio.
Skates *Raja* species	34, 35, 140, 638. R. Miller, Halgren.
Atlantic stingray *Dasyatus sabina*	35. Beck.
Cownose ray *Rhinoptera bonansus*	34, 35, 636. R. Miller.
Shortnose sturgeon *Acipenser brevirostrum*	34, 67, 132, 192, 201, 233, 494, 727. Brundage, Maiden.
Atlantic sturgeon *Acipenser oxyrhynchus*	34, 67, 140, 192, 201, 287, 331, 416, 727. Brundage, Maiden.
American eel *Anguilla rostrata*	34, 140, 170, 416, 638, 727. R. Miller, Beck.
Blueback herring *Alosa aestivalis*	34, 192, 287, 444, 447, 464, 727. J. Miller, Lupine, Beck, Maiden.
Alewife *Alosa pseudoharengus*	34, 173, 192, 287, 444, 447, 464, 727. J. Miller, Lupine, Beck.
American shad *Alosa sapidissima*	34, 96, 192, 287, 367, 416, 727, 731. R. Miller, J. Miller, Lupine, Beck.
Atlantic menhaden *Brevoortia tyrannus*	34, 140, 192, 287, 416, 574, 638, 727. R. Miller, Beck.
Atlantic herring *Clupea harengus*	34, 133, 287, 297, 727. R. Miller, Halgren, Beck.
Bay anchovy *Anchoa mitchilli*	34, 192, 287, 459. Beck, Maiden.
Channel catfish *Ictalurus punctatus*	230, 287, 341, 550. R. Miller, Halgren, Beck, Maiden.
Rainbow smelt *Osmerus mordax*	34, 70, 727. Beck.
Atlantic salmon *Salmo salar*	34, 36, 135. Beck.
Atlantic cod *Gadus morhua*	34, 140, 230, 647, 727. Field.
Haddock *Melanogrammus aeglefinus*	34, 230, 647, 727. Field.
Atlantic tomcod *Microgadus tomcod*	34, 230, 665, 727. Field.
Pollock *Pollachius virens*	140, 230, 727. Beck.
Red hake *Urophycis chuss*	34, 140, 230, 638, 727. Beck.

Numbers correspond to references listed in Appendix 4, pp. 245-280.
Names correspond to individuals listed in Appendix 3, pp. 239-243.

Species	Delaware Bay, continued
Oyster toadfish *Opsanus tau*	34, 140, 341, 390, 638. Seagraves.
Sheepshead minnow *Cyprinodon variegatus*	7, 34, 140, 230, 444, 550. Seagraves.
Killifishes *Fundulus* species	7, 34, 140, 230, 550, 444. Taylor.
Silversides *Menidia* species	34, 140, 174, 444. Beck.
Northern pipefish *Syngnathus fuscus*	140, 230, 330, 444. Seagraves.
Northern searobin *Prionotus carolinus*	34, 140, 195, 638. Halgren.
White perch *Morone americana*	140, 192, 231, 638, 658, 727. Beck, R. Miller.
Striped bass *Morone saxatilis*	94, 176, 192, 231, 303, 727. Seagraves, J. Miller, Lupine, Beck, Maiden.
Black sea bass *Centropristis striata*	140, 231, 436, 469. R. Miller, Beck.
Yellow perch *Perca flavescens*	140, 231, 341. R. Miller, Beck.
Bluefish *Pomatomus saltatrix*	34, 140, 192, 514, 727. R. Miller, Beck.
Pinfish *Lagodon rhomboides*	140, 285, 465, 514. Beck.
Scup *Stenotomus chrysops*	140, 192, 285, 514, 638, 727. R. Miller, Beck.
Spotted seatrout *Cynoscion nebulosus*	284, 285. R. Miller, Beck, Michels.
Weakfish *Cynoscion regalis*	192, 204, 205, 285, 288, 416, 435, 638, 727. R. Miller, Halgren, Taylor, Beck.
Spot *Leiostomus xanthurus*	140, 285, 533, 638, 727. Beck, Maiden.
Northern kingfish *Menticirrhus saxatilis*	34, 140, 285, 638. Beck.
Atlantic croaker *Micropogonias undulatus*	140, 285, 514, 638. R. Miller, Halgren, Beck.
Black drum *Pogonias cromis*	140, 285, 638, 671. R. Miller, Halgren, Beck.
Red drum *Sciaenops ocellatus*	140, 285, 444, 552, 638. R. Miller, Beck.
Mullets *Mugil* species	107, 108, 140, 390, 514. R. Miller, Beck.
Tautog *Tautoga onitis*	19, 140, 195, 514, 638, 727. R. Miller, Halgren.
Cunner *Tautogolabrus adspersus*	19, 140, 195, 514, 638. Beck.
American sand lance *Ammodytes americanus*	20, 140, 195, 638. Beck.
Gobies *Gobiosoma* species	136, 341. Beck.
Atlantic mackerel *Scomber scombrus*	34, 140, 195, 514, 727. Seagraves.
Butterfish *Peprilus triacanthus*	34, 390, 514, 638, 727. Beck.
Summer flounder *Paralichthys dentatus*	34, 140, 192, 210, 390, 573, 639, 727. R. Miller.
Windowpane flounder *Scophthalmus aquousus*	140, 390, 638, 727. Beck.
Winter flounder *Pleuronectes americanus*	71, 210, 390, 727. Halgren, Beck.
Hogchoker *Trinectes maculatus*	34, 140, 390, 638. R. Miller, Beck.

Numbers correspond to references listed in Appendix 4, pp. 245-280.
Names correspond to individuals listed in Appendix 3, pp. 239-243.

Appendix 2, continued. Table of references and personal communications

Species	Delaware Inland Bays
Blue mussel *Mytilus edulis*	474, 728. Tinsman, Michels, Cole, Goodger.
Bay scallop *Argopecten irradians*	175, 728. Tinsman, Michels, Cole.
American oyster *Crassostrea virginica*	661, 728. Tinsman, Michels, Cole, Anderson.
Northern quahog *Mercenaria* species	8, 105, 657, 728. Tinsman, Michels, Cole.
Softshell clam *Mya arenaria*	8, 728. Tinsman, Michels, Cole, Anderson.
Brown shrimp *Peneaus aztecus*	324, 332, 389, 746. Tinsman, Michels, Cole.
Daggerblade grass shrimp *Palaemonetes pugio*	14, 332, 389, 746. Daiber.
Sevenspine bay shrimp *Crangon septemspinosa*	332, 389, 545, 746. Daiber, Field.
American lobster *Homarus americanus*	332, 366, 746. Tinsman, Michels, Cole.
Blue crab *Callinectes sapidus*	150, 165, 253, 332, 389, 745, 746. Tinsman, Michels, Cole, Daiber.
Skates *Raja* species	34, 35, 140, 728. Daiber.
Atlantic stingray *Dasyatus sabina*	35. Daiber.
Cownose ray *Rhinoptera bonansus*	34, 35, 636, 637. Daiber.
Shortnose sturgeon *Acipenser brevirostrum*	34, 87, 132, 143, 201, 444, 728. Shirey, Brundage.
Atlantic sturgeon *Acipenser oxyrhynchus*	34, 87, 134, 143, 201, 287, 444, 728. Brundage, Goodger.
American eel *Anguilla rostrata*	34, 87, 143, 170, 281. Tinsman, Michels, Cole, Anderson.
Blueback herring *Alosa aestivalis*	34, 87, 134, 143, 162, 287, 464. Goodger, Anderson, Shirey.
Alewife *Alosa pseudoharengus*	34, 87, 134, 162, 173, 281, 287, 464. Goodger, Shirey.
American shad *Alosa sapidissima*	34, 87, 134, 143, 162, 287, 367, 444. Tinsman, Michels, Cole, Goodger.
Atlantic menhaden *Brevoortia tyrannus*	34, 87, 162, 281, 287, 416, 574, 728. Anderson, Shirey.
Atlantic herring *Clupea harengus*	34, 143, 287, 297, 389, 727. Seagraves.
Bay anchovy *Anchoa mitchilli*	34, 143, 281, 287, 444, 459, 611, 728. Anderson.
Channel catfish *Ictalurus punctatus*	143, 287, 389, 550, 728. Tinsman, Michels, Cole.
Rainbow smelt *Osmerus mordax*	34, 70, 87, 143, 444, 728. Field.
Atlantic salmon *Salmo salar*	34, 36, 135, 444, 728. Tinsman, Michels, Cole.
Atlantic cod *Gadus morhua*	34, 140, 230, 444, 647, 728. Field.
Haddock *Melanogrammus aeglefinus*	34, 140, 230, 444, 647, 728. Field.
Atlantic tomcod *Microgadus tomcod*	34, 230, 665, 444, 728. Field.
Pollock *Pollachius virens*	34, 230, 444, 728. Field.
Red hake *Urophycis chuss*	34, 230, 444, 638, 728. Seagraves.

Numbers correspond to references listed in Appendix 4, pp. 245-280.
Names correspond to individuals listed in Appendix 3, pp. 239-243.

Species	Delaware Inland Bays, continued
Oyster toadfish *Opsanus tau*	34, 87, 140, 281, 341, 389, 390. Fine.
Sheepshead minnow *Cyprinodon variegatus*	7, 34, 87, 230, 389, 728. Daiber.
Killifishes *Fundulus* species	7, 34, 230, 281, 444, 624, 728. Daiber.
Silversides *Menidia* species	34, 143, 174, 281, 611, 728. Daiber.
Northern pipefish *Syngnathus fuscus*	143, 230, 330, 444, 611. Daiber.
Northern searobin *Prionotus carolinus*	34, 195, 281, 389, 444. Daiber.
White perch *Morone americana*	231, 281, 444, 611, 624, 658. Daiber.
Striped bass *Morone saxatilis*	87, 143, 162, 176, 231, 444. Anderson, Shirey.
Black sea bass *Centropristis striata*	231, 281, 436, 444, 728. Anderson, Shirey.
Yellow perch *Perca flavescens*	231, 281, 341. Shirey.
Bluefish *Pomatomus saltatrix*	143, 281, 389, 444, 514, 728. Anderson, Daiber.
Pinfish *Lagodon rhomboides*	140, 285, 465, 514. Daiber.
Scup *Stenotomus chrysops*	140, 143, 285, 514. Seagraves.
Spotted seatrout *Cynoscion nebulosus*	87, 140, 143, 281, 284, 285, 444. Anderson, Daiber.
Weakfish *Cynoscion regalis*	162, 192, 281, 285, 435, 444. Daiber, Shirey.
Spot *Leiostomus xanthurus*	87, 143, 162, 285, 389, 533, 611. Daiber.
Northern kingfish *Menticirrhus saxatilis*	34, 140, 143, 285, 444. Daiber.
Atlantic croaker *Micropogonias undulatus*	143, 162, 281, 285. Tinsman, Michels, Cole, Anderson.
Black drum *Pogonias cromis*	143, 281, 285, 671. Anderson, Daniel, Shirey.
Red drum *Sciaenops ocellatus*	140, 143, 281, 285, 389, 444, 552. Daiber.
Mullets *Mugil* species	107, 108, 281, 390, 444, 728. Seagraves.
Tautog *Tautoga onitis*	19, 34, 143, 195, 444. Anderson, Martin.
Cunner *Tautogolabrus adspersus*	19, 143, 195, 281, 444, 611. Anderson, Martin, Shirey.
American sand lance *Ammodytes americanus*	20, 162, 195. Cole.
Gobies *Gobiosoma* species	87, 136, 143, 162, 611. Cole.
Atlantic mackerel *Scomber scombrus*	34, 140, 143, 195, 389, 444, 728. Seagraves.
Butterfish *Peprilus triacanthus*	143, 341, 389, 390, 444, 514. Cole.
Summer flounder *Paralichthys dentatus*	143, 162, 210, 281, 390, 573, 728. Michels, Anderson, Shirey.
Windowpane flounder *Scophthalmus aquousus*	34, 140, 143, 390, 444, 727. Cole.
Winter flounder *Pleuronectes americanus*	71, 162, 210, 281, 390, 728. Cole, Price, Shirey.
Hogchoker *Trinectes maculatus*	143, 389, 390, 638, 728. Cole, Daiber.

Numbers correspond to references listed in Appendix 4, pp. 245-280.
Names correspond to individuals listed in Appendix 3, pp. 239-243.

Appendix 2, continued. Table of references and personal communications

Species	Chincoteague Bay
Blue mussel *Mytilus edulis*	470, 474, 603. Casey, Castagna, Scott.
Bay scallop *Argopecten irradians*	175, 470. Casey, Castagna, Scott.
American oyster *Crassostrea virginica*	273, 470, 661. Casey, Castagna, Scott.
Northern quahog *Mercenaria mercenaria*	273, 470, 657, 659, 721. Casey, Castagna, Scott.
Softshell clam *Mya arenaria*	8, 470. Casey, Castagna, Scott.
Brown shrimp *Peneaus aztecus*	91, 324, 470, 746. Casey.
Daggerblade grass shrimp *Palaemonetes pugio*	14, 91, 470, 746. Casey.
Sevenspine bay shrimp *Crangon septemspinosa*	91, 470, 746. Casey.
American lobster *Homarus americanus*	91, 366, 470, 746. Casey.
Blue crab *Callinectes sapidus*	88, 91, 253, 273, 470, 629, 745, 746. Casey.
Skates *Raja* species	34, 35, 91, 393, 470, 485, 554, 603, 605. Casey.
Atlantic stingray *Dasyatus sabina*	35, 91, 393, 470, 485, 554, 603, 605. Casey.
Cownose ray *Rhinoptera bonansus*	34, 35, 91, 393, 470, 485, 554, 603, 605, 637. Casey.
Shortnose sturgeon *Acipenser brevirostrum*	34, 91, 132, 201, 393, 470, 485, 554, 603, 605. Casey.
Atlantic sturgeon *Acipenser oxyrhynchus*	34, 91, 201, 287, 393, 470, 485, 554, 603, 605. Casey.
American eel *Anguilla rostrata*	34, 91, 170, 230, 393, 470, 485, 554, 603, 605, 692. Casey.
Blueback herring *Alosa aestivalis*	34, 91, 173, 287, 464, 393, 470, 485, 554, 603, 605. Casey.
Alewife *Alosa pseudoharengus*	34, 91, 173, 287, 464, 393, 470, 485, 554, 603, 605. Casey.
American shad *Alosa sapidissima*	34, 91, 287, 367, 393, 470, 485, 554, 603, 605. Casey.
Atlantic menhaden *Brevoortia tyrannus*	34, 91, 287, 393, 470, 485, 574, 554, 603, 605. Casey.
Atlantic herring *Clupea harengus*	34, 91, 287, 297, 393, 470, 485, 554, 603, 605. Casey.
Bay anchovy *Anchoa mitchilli*	34, 91, 287, 393, 459, 470, 485, 554, 603, 605. Casey.
Channel catfish *Ictalurus punctatus*	91, 287, 393, 470, 485, 554, 603, 605. Casey.
Rainbow smelt *Osmerus mordax*	34, 70, 91, 393, 470, 485, 554, 603, 605. Casey.
Atlantic salmon *Salmo salar*	34, 91, 135, 393, 470, 485, 554, 603, 605. Casey.
Atlantic cod *Gadus morhua*	34, 91, 230, 393, 470, 485, 554, 603, 605, 647. Casey.
Haddock *Melanogrammus aeglefinus*	34, 230, 91, 393, 470, 485, 554, 603, 605, 647. Casey.
Atlantic tomcod *Microgadus tomcod*	34, 91, 230, 393, 470, 485, 554, 603, 605, 665. Casey.
Pollock *Pollachius virens*	91, 230, 393, 470, 485, 554, 603, 605. Casey.
Red hake *Urophycis chuss*	34, 91, 230, 393, 470, 485, 554, 603, 605. Casey.

Numbers correspond to references listed in Appendix 4, pp. 245-280.
Names correspond to individuals listed in Appendix 3, pp. 239-243.

Species	Chincoteague Bay, continued
Oyster toadfish *Opsanus tau*	91, 341, 390, 393, 470, 485, 554, 603, 605. Casey.
Sheepshead minnow *Cyprinodon variegatus*	34, 91, 230, 393, 470, 485, 554, 603, 605. Casey.
Killifishes *Fundulus* species	7, 91, 230, 393, 470, 485, 554, 603, 605. Casey.
Silversides *Menidia* species	91, 174, 390, 393, 470, 485, 554, 603, 605. Casey.
Northern pipefish *Syngnathus fuscus*	91, 230, 330, 393, 470, 485, 554, 603, 605. Casey.
Northern searobin *Prionotus carolinus*	91, 195, 393, 470, 485, 554, 603, 605. Casey.
White perch *Morone americana*	91, 231, 393, 470, 485, 554, 603, 605, 658. Casey.
Striped bass *Morone saxatilis*	91, 176, 231, 393, 470, 485, 554, 603, 605. Casey.
Black sea bass *Centropristis striata*	17, 91, 231, 393, 436, 470, 485, 554, 603, 605. Casey.
Yellow perch *Perca flavescens*	91, 231, 393, 470, 485, 554, 603, 605. Casey.
Bluefish *Pomatomus saltatrix*	91, 231, 298, 393, 470, 485, 497, 537, 554, 603, 605. Casey.
Pinfish *Lagodon rhomboides*	91, 285, 393, 465, 470, 485, 554, 603, 605. Casey.
Scup *Stenotomus chrysops*	91, 285, 393, 470, 485, 554, 603, 605. Casey.
Spotted seatrout *Cynoscion nebulosus*	91, 284, 285, 393, 470, 485, 554, 603, 605. Casey.
Weakfish *Cynoscion regalis*	91, 285, 393, 435, 470, 485, 554, 603, 605. Casey.
Spot *Leiostomus xanthurus*	91, 285, 393, 470, 485, 533, 554, 603, 605. Casey.
Northern kingfish *Menticirrhus saxatilis*	91, 285, 393, 470, 485, 554, 603, 605. Casey.
Atlantic croaker *Micropogonias undulatus*	91, 285, 326, 393, 470, 485, 554, 603, 605. Casey.
Black drum *Pogonias cromis*	91, 285, 393, 470, 485, 554, 603, 605, 671. Casey.
Red drum *Sciaenops ocellatus*	91, 285, 393, 470, 485, 552, 554, 603, 605. Casey.
Mullets *Mugil* species	91, 107, 108, 390, 393, 470, 485, 554, 603, 605. Casey.
Tautog *Tautoga onitis*	19, 34, 91, 195, 393, 470, 485, 554, 603, 605. Casey.
Cunner *Tautogolabrus adspersus*	19, 34, 91, 195, 393, 470, 485, 554, 603, 605. Casey.
American sand lance *Ammodytes americanus*	20, 91, 195, 393, 470, 485, 554, 603, 605. Casey.
Gobies *Gobiosoma* species	91, 136, 195, 393, 470, 485, 554, 603, 605. Casey.
Atlantic mackerel *Scomber scombrus*	91, 195, 393, 470, 485, 554, 603, 605. Casey.
Butterfish *Peprilus triacanthus*	91, 390, 393, 470, 485, 554, 603, 605. Casey.
Summer flounder *Paralichthys dentatus*	91, 210, 390, 393, 470, 485, 554, 573, 603, 605. Casey.
Windowpane flounder *Scophthalmus aquousus*	34, 91, 390, 393, 470, 485, 554, 603, 605. Casey.
Winter flounder *Pleuronectes americanus*	71, 91, 210, 390, 393, 470, 485, 554, 603, 605. Casey.
Hogchoker *Trinectes maculatus*	34, 91, 390, 393, 470, 485, 554, 603, 605. Casey.

Numbers correspond to references listed in Appendix 4, pp. 245-280.
Names correspond to individuals listed in Appendix 3, pp. 239-243.

Appendix 2, continued. Table of references and personal communications

Species	Chesapeake Bay mainstem
Blue mussel *Mytilus edulis*	341, 473, 474, 475, 549, 708. Barber, Newell, M.P. Lynch.
Bay scallop *Argopecten irradians*	175, 587, 708. Barber, Dupaul.
American oyster *Crassostrea virginica*	1, 2, 15, 31, 124, 163, 196, 235, 236, 238, 242, 299, 316, 341, 345, 404, 455, 476, 507, 551, 568, 569, 582, 661, 708, 730. Barber, Newell.
Northern quahog *Mercenaria mercenaria*	137, 139, 193, 196, 194, 320, 321, 341, 657, 703, 708. Barber.
Softshell clam *Mya arenaria*	8, 196, 258, 341, 345, 300, 355, 376, 526, 527, 530, 620, 708. Barber, Kennedy.
Brown shrimp *Peneaus aztecus*	242, 324, 708, 743, 744, 746. Lipcius.
Daggerblade grass shrimp *Palaemonetes pugio*	14, 48, 138, 242, 341, 548, 580, 593, 679, 708, 746. Lipcius, Van Heukelem.
Sevenspine bay shrimp *Crangon septemspinosa*	78, 118, 123, 221, 261, 451, 546, 708, 711, 712, 746. Lipcius.
American lobster *Homarus americanus*	86, 100, 116, 181, 366, 432, 708, 746. Lipcius, Olney.
Blue crab *Callinectes sapidus*	16, 163, 196, 198, 199, 202, 203, 239, 242, 253, 259, 283, 286, 312, 336, 337, 338, 341, 345, 365, 385, 442, 542, 520, 586, 587, 588, 592, 625, 695, 696, 745, 746. Gibbs, Lipcius, M.P. Lynch, Van Heukelem.
Skates *Raja* species	34, 35, 251, 341, 413, 414, 547, 554, 688, 708. Branstetter, Sminkey, Tabbit.
Atlantic stingray *Dasyatus sabina*	35, 251, 341, 554, 608, 649, 688, 708. Branstetter, Sminkey, Tabbit.
Cownose ray *Rhinoptera bonansus*	34, 35, 39, 40, 251, 341, 371, 554, 635, 636, 637, 688, 708. Branstetter, Sminkey, Tabbit.
Shortnose sturgeon *Acipenser brevirostrum*	34, 65, 68, 69, 132, 201, 233, 251, 341, 554, 642, 688, 708. Colvocoresses, Seaver, Estes.
Atlantic sturgeon *Acipenser oxyrhynchus*	34, 201, 251, 287, 341, 331, 554, 641, 643, 688, 708. Colvocoresses, Seaver, Estes.
American eel *Anguilla rostrata*	27, 34, 97, 170, 171, 243, 251, 341, 554, 688, 692, 708, 724, 725, 726. Wiley, Olney, Colvocoresses.
Blueback herring *Alosa aestivalis*	30, 34, 42, 43, 74, 75, 89, 145, 173, 196, 198, 199, 251, 271, 287, 307, 317, 341, 346, 347, 348, 349, 396, 463, 464, 515, 554, 652, 683, 688, 698, 708, 714, 715, 716, 718. Dixon, Loesch.
Alewife *Alosa pseudoharengus*	34, 42, 43, 89, 98, 145, 173, 196, 198, 199, 251, 271, 287, 317, 318, 341, 346, 347, 348, 349, 367, 394, 396, 463, 464, 515, 554, 652, 688, 698, 708, 714, 715, 716, 718. Dixon, Loesch.
American shad *Alosa sapidissima*	34, 42, 43, 89, 98, 145, 196, 198, 199, 251, 271, 287, 317, 318, 341, 346, 347, 348, 349, 367, 394, 396, 463, 515, 554, 652, 688, 698, 708, 714, 715, 716, 718. Dixon, Loesch.
Atlantic menhaden *Brevoortia tyrannus*	18, 34, 187, 189, 196, 574, 198, 199, 251, 287, 307, 319, 341, 396, 397, 410, 418, 496, 515, 516, 554, 688, 698, 708. Olney, Houde, Desfosse, Lucy.
Atlantic herring *Clupea harengus*	34, 198, 199, 251, 287, 297, 341, 396, 515, 554, 688, 698, 708. Colvocoresses, Seaver, Estes.
Bay anchovy *Anchoa mitchilli*	34, 79, 89, 121, 152, 196, 198, 199, 251, 287, 307, 341, 358, 396, 459, 501, 502, 515, 554, 575, 619, 687, 688, 698, 708. Colvocoresses, Houde, Luo.
Channel catfish *Ictalurus punctatus*	198, 199, 251, 287, 307, 323, 341, 396, 433, 515, 575, 688, 698, 708, 719. Colvocoresses, Estes, Seaver.
Rainbow smelt *Osmerus mordax*	34, 70, 198, 199, 251, 341, 396, 515, 688, 698, 708. Colvocoresses.
Atlantic salmon *Salmo salar*	34, 135, 198, 199, 251, 341, 396, 515, 688, 698, 708. Colvocoresses.
Atlantic cod *Gadus morhua*	198, 199, 230, 251, 341, 396, 515, 647, 688, 698, 708. Colvocoresses, Olney.
Haddock *Melanogrammus aeglefinus*	198, 199, 230, 251, 341, 396, 515, 647, 688, 698, 708. Colvocoresses.
Atlantic tomcod *Microgadus tomcod*	34, 198, 199, 230, 251, 341, 396, 515, 665, 688, 698, 708. Colvocoresses.
Pollock *Pollachius virens*	34, 198, 199, 230, 251, 341, 396, 515, 688, 698, 708. Colvocoresses, Olney.
Red hake *Urophycis chuss*	25, 26, 34, 110, 198, 199, 230, 251, 341, 396, 515, 554, 688, 698, 708. Colvocoresses, Olney.

Numbers correspond to references listed in Appendix 4, pp. 245-280.
Names correspond to individuals listed in Appendix 3, pp. 239-243.

Species	Chesapeake Bay mainstem, continued
Oyster toadfish *Opsanus tau*	198, 199, 251, 341, 390, 396, 515, 534, 554, 688, 698, 708. Carter, Colvocoresses, Estes, Seaver.
Sheepshead minnow *Cyprinodon variegatus*	230, 251, 275, 341, 396, 515, 554, 688, 698, 708. Carmichael, Colvocoresses, Estes, Gear, Seaver, Weisberg.
Killifishes *Fundulus* species	5, 7, 24, 84, 230, 251, 260, 263, 341, 396, 445, 456, 515, 554, 579, 580, 688, 698, 708, 713. Carmichael, Colvocoresses, Estes, Gear, Seaver, Weisberg.
Silversides *Menidia* species	29, 77, 120, 174, 251, 307, 341, 390, 396, 515, 554, 445, 688, 698, 708. Colvocoresses, Estes, Gear, Seaver.
Northern pipefish *Syngnathus fuscus*	230, 251, 341, 396, 434, 502, 515, 554, 583, 584, 585, 688, 698, 708. Carter, Colvocoresses, Gear.
Northern searobin *Prionotus carolinus*	195, 198, 199, 251, 341, 375, 387, 396, 412, 515, 554, 562, 688, 698, 708, 752, 757. Carter, Chittenden, Estes, Seaver, Uphoff.
White perch *Morone americana*	47, 89, 90, 196, 198, 199, 231, 251, 307, 317, 341, 384, 396, 515, 554, 563, 575, 576, 619, 652, 655, 656, 658, 688, 698, 708. Colvocoresses, Houde, Olney.
Striped bass *Morone saxatilis*	44, 45, 89, 119, 176, 179, 196, 198, 199, 206, 224, 225, 231, 251, 310, 317, 325, 341, 396, 415, 503, 506, 515, 554, 589, 645, 652, 684, 688, 698, 708. Colvocoresses, Houde, Olney.
Black sea bass *Centropristis striata*	198, 199, 231, 251, 341, 396, 436, 515, 554, 687, 688, 698, 708. Colvocoresses, Gear.
Yellow perch *Perca flavescens*	90, 159, 160, 161, 196, 198, 199, 231, 251, 307, 341, 396, 515, 554, 618, 688, 698, 708, 719. Colvocoresses, Estes, Gear, Seaver.
Bluefish *Pomatomus saltatrix*	231, 251, 298, 341, 396, 486, 515, 537, 554, 688, 689, 698, 708. Colvocoresses, Olney, Uphoff.
Pinfish *Lagodon rhomboides*	198, 199, 251, 285, 341, 396, 465, 515, 688, 698, 706, 708. Colvocoresses, Estes, Gear, Seaver.
Scup *Stenotomus chrysops*	198, 199, 251, 285, 341, 396, 457, 515, 554, 644, 646, 688, 698, 708. Colvocoresses, Lippson, Olney.
Spotted seatrout *Cynoscion nebulosus*	64, 198, 199, 251, 274, 284, 285, 341, 396, 441, 515, 554, 688, 698, 708. Chittenden, Stagg, Uphoff.
Weakfish *Cynoscion regalis*	22, 92, 113, 120, 121, 198, 199, 251, 285, 341, 395, 396, 399, 435, 440, 501, 511, 515, 554, 575, 609, 612, 688, 698, 708, 736, 737. Chittenden, Lowerre, Olney, Stagg, Uphoff.
Spot *Leiostomus xanthurus*	92, 113, 120, 121, 196, 198, 199, 251, 256, 257, 285, 307, 341, 396, 403, 445, 481, 495, 511, 512, 513, 515, 533, 554, 575, 688, 698, 708, 717. Chittenden, Olney, Wiley, C.D. Williams.
Northern kingfish *Menticirrhus saxatilis*	113, 121, 198, 199, 251, 285, 341, 396, 515, 554, 688, 698, 708. Chittenden, Colvocoresses, Olney.
Atlantic croaker *Micropogonias undulatus*	41, 92, 113, 121, 198, 199, 251, 257, 285, 341, 396, 515, 480, 482, 483, 484, 502, 575, 688, 698, 708, 737. Barbieri, Carter, Chittenden, Olney.
Black drum *Pogonias cromis*	122, 144, 190, 198, 199, 251, 285, 289, 341, 396, 515, 554, 671, 688, 698, 708. Chittenden, Lippson, Olney.
Red drum *Sciaenops ocellatus*	92, 113, 198, 199, 251, 285, 341, 379, 396, 515, 523, 552, 554, 688, 698, 708. Cavaluzzi, Chittenden, Lippson, Olney.
Mullets *Mugil* species	107, 108, 198, 199, 251, 341, 390, 396, 515, 554, 688, 698, 708. Colvocoresses, Estes, Gear, Seaver.
Tautog *Tautoga onitis*	19, 195, 198, 199, 251, 341, 396, 499, 500, 515, 554, 662, 688, 698, 708. Colvocoresses, Estes, Seaver, M.P. Lynch.
Cunner *Tautogolabrus adspersus*	19, 195, 198, 199, 251, 341, 388, 396, 515, 554, 688, 698, 708, 755. Colvocoresses.
American sand lance *Ammodytes americanus*	20, 195, 251, 341, 437, 477, 560, 688, 708, 750. Colvocoresses, Estes, Seaver.
Gobies *Gobiosoma* species	50, 136, 195, 251, 341, 396, 398, 554, 618, 619, 621, 688, 698, 708. Breitburg, Colvocoresses, Estes, Seaver.
Atlantic mackerel *Scomber scombrus*	195, 198, 199, 251, 341, 396, 458, 515, 554, 617, 634, 648, 670, 688, 698, 708, 740. Chittenden, Colvocoresses, Olney.
Butterfish *Peprilus triacanthus*	198, 199, 251, 341, 390, 396, 515, 554, 648, 670, 688, 698, 708, 740. Colvocoresses, Estes, Gear, Seaver.
Summer flounder *Paralichthys dentatus*	142, 164, 198, 199, 210, 251, 341, 390, 396, 515, 554, 575, 688, 697, 698, 708, 754. Desfosse, Gear, Musick, Olney.
Windowpane flounder *Scophthalmus aquousus*	198, 199, 251, 341, 390, 396, 515, 688, 698, 708. Carter, Desfosse, Musick, Olney.
Winter flounder *Pleuronectes americanus*	198, 199, 210, 251, 341, 390, 396, 515, 554, 688, 698, 708. Carter, Desfosse, Musick, Olney.
Hogchoker *Trinectes maculatus*	198, 199, 251, 341, 390, 396, 510, 515, 554, 575, 619, 640, 688, 698, 708. Carter, Colvocoresses, Estes, Seaver, Wiley.

Numbers correspond to references listed in Appendix 4, pp. 245-280.
Names correspond to individuals listed in Appendix 3, pp. 239-243.

Species	Chester River
Blue mussel *Mytilus edulis*	340, 341, 474. Lippson.
Bay scallop *Argopecten irradians*	175, 340, 341. Lippson.
American oyster *Crassostrea virginica*	31, 196, 316, 340, 341, 661. Newell.
Northern quahog *Mercenaria mercenaria*	196, 340, 341, 657, 659. Lippson.
Softshell clam *Mya arenaria*	8, 196, 340, 341, 472. Kennedy.
Brown shrimp *Peneaus aztecus*	250, 324, 341, 746. Lippson.
Daggerblade grass shrimp *Palaemonetes pugio*	14, 340, 341, 746. Van Heukelem.
Sevenspine bay shrimp *Crangon septemspinosa*	340, 341, 746. A.B. Williams.
American lobster *Homarus americanus*	341, 366, 746. Lippson.
Blue crab *Callinectes sapidus*	196, 253, 340, 341, 745, 746. Van Heukelem.
Skates *Raja* species	34, 35, 250, 340, 341. Schwartz.
Atlantic stingray *Dasyatus sabina*	35, 341. Schwartz.
Cownose ray *Rhinoptera bonansus*	34, 35, 250, 341. Schwartz.
Shortnose sturgeon *Acipenser brevirostrum*	34, 132, 201. O'Dell.
Atlantic sturgeon *Acipenser oxyrhynchus*	34, 201, 287. O'Dell.
American eel *Anguilla rostrata*	34, 148, 149, 170, 250, 341, 462. Wiley.
Blueback herring *Alosa aestivalis*	34, 196, 250, 287, 341, 462, 464. O'Dell.
Alewife *Alosa pseudoharengus*	34, 173, 196, 250, 287, 341, 462, 464. O'Dell.
American shad *Alosa sapidissima*	34, 196, 287, 367, 378, 250, 341, 462. O'Dell.
Atlantic menhaden *Brevoortia tyrannus*	34, 196, 287, 574. Houde.
Atlantic herring *Clupea harengus*	34, 287, 297. Field.
Bay anchovy *Anchoa mitchilli*	34, 196, 250, 287, 341, 459. Houde.
Channel catfish *Ictalurus punctatus*	250, 287, 462, 581, 653. O'Dell.
Rainbow smelt *Osmerus mordax*	70. Field.
Atlantic salmon *Salmo salar*	34, 135. Field.
Atlantic cod *Gadus morhua*	34, 230, 250, 341, 647. Lippson.
Haddock *Melanogrammus aeglefinus*	34, 230, 341, 647. Lippson.
Atlantic tomcod *Microgadus tomcod*	34, 230, 665. Field.
Pollock *Pollachius virens*	230, 250, 341. Lippson.
Red hake *Urophycis chuss*	34, 230. Lippson.

Numbers correspond to references listed in Appendix 4, pp. 245-280.
Names correspond to individuals listed in Appendix 3, pp. 239-243.

Species	Chester River, continued
Oyster toadfish *Opsanus tau*	250, 390, 462, 581. Carter, Gemignani, Jordan, Mihursky, Uphoff.
Sheepshead minnow *Cyprinodon variegatus*	230, 250, 341, 581. Hershfield.
Killifishes *Fundulus* species	7, 230, 250, 341, 581. Hershfield.
Silversides *Menidia* species	174, 250, 341, 462, 581. Carter, Gemignani, Jordan, Mihursky, Schwartz, Uphoff.
Northern pipefish *Syngnathus fuscus*	230, 250, 330, 341, 462, 581. Carter, Gemignani, Jordan, Mihursky, Uphoff.
Northern searobin *Prionotus carolinus*	195. Carter, Gemignani, Mihursky, Uphoff.
White perch *Morone americana*	196, 231, 250, 341, 462, 653, 654, 658. Houde.
Striped bass *Morone saxatilis*	176, 196, 231, 250, 341, 581, 653, 654. Houde.
Black sea bass *Centropristis striata*	231, 250, 341, 436, 581, 653. Lippson.
Yellow perch *Perca flavescens*	159, 160, 161, 196, 231, 250, 341, 462, 491, 581, 653, 654. O'Dell.
Bluefish *Pomatomus saltatrix*	231, 250, 298, 341, 537, 581, 653, 702, 735. Carter, Gemignani, Mihursky, Uphoff.
Pinfish *Lagodon rhomboides*	250, 285, 341, 465. Lippson.
Scup *Stenotomus chrysops*	285. Lippson.
Spotted seatrout *Cynoscion nebulosus*	250, 284, 285, 341, 462, 581, 653. Carter, Gemignani, Mihursky, Stagg, Uphoff.
Weakfish *Cynoscion regalis*	155, 285, 435, 581, 653. Carter, Gemignani, Mihursky, Stagg, Uphoff.
Spot *Leiostomus xanthurus*	250, 285, 341, 462, 533, 581, 653. Wiley.
Northern kingfish *Menticirrhus saxatilis*	285. Lippson.
Atlantic croaker *Micropogonias undulatus*	250, 285, 341, 581, 653. Carter, Gemignani, Jordan, Mihursky, Uphoff.
Black drum *Pogonias cromis*	250, 285, 341, 581, 653, 671. Lippson.
Red drum *Sciaenops ocellatus*	250, 285, 341, 552, 581, 653. Lippson.
Mullets *Mugil* species	107, 108, 250, 341, 390, 462, 581, 653. Lippson.
Tautog *Tautoga onitis*	19, 195, 250, 341, 653. Lippson.
Cunner *Tautogolabrus adspersus*	19, 195. Lippson.
American sand lance *Ammodytes americanus*	20, 195, 250, 341. Lippson.
Gobies *Gobiosoma* species	50, 136, 195, 341, 621. Breitburg.
Atlantic mackerel *Scomber scombrus*	195, 250, 341, 616. Lippson.
Butterfish *Peprilus triacanthus*	250, 341, 390. Lippson.
Summer flounder *Paralichthys dentatus*	200, 210, 390, 573, 581, 653. Stagg.
Windowpane flounder *Scophthalmus aquousus*	250, 341, 390. Carter, Gemignani, Jordan, Mihursky, Uphoff.
Winter flounder *Pleuronectes americanus*	210, 390, 581, 653. Carter, Gemignani, Jordan, Mihursky, Uphoff.
Hogchoker *Trinectes maculatus*	250, 341, 390, 462, 581. Wiley.

Numbers correspond to references listed in Appendix 4, pp. 245-280.
Names correspond to individuals listed in Appendix 3, pp. 239-243.

Appendix 2, continued. Table of references and personal communications

Species	Choptank River
Blue mussel *Mytilus edulis*	340, 341, 474, 653. Lippson.
Bay scallop *Argopecten irradians*	175, 340, 341, 653. Lippson.
American oyster *Crassostrea virginica*	31, 196, 316, 340, 341, 581, 653, 661. Newell.
Northern quahog *Mercenaria mercenaria*	196, 340, 341, 653, 657, 659. Lippson.
Softshell clam *Mya arenaria*	8, 196, 340, 341, 472. Kennedy.
Brown shrimp *Peneaus aztecus*	250, 324, 341, 746. Lippson.
Daggerblade grass shrimp *Palaemonetes pugio*	14, 340, 341, 746. Van Heukelem.
Sevenspine bay shrimp *Crangon septemspinosa*	340, 341, 746. A.B. Williams.
American lobster *Homarus americanus*	341, 366, 746. Lippson.
Blue crab *Callinectes sapidus*	196, 253, 340, 341, 745, 746. Van Heukelem.
Skates *Raja* species	34, 35, 340, 341, 653. Schwartz.
Atlantic stingray *Dasyatus sabina*	35, 250, 341. Schwartz.
Cownose ray *Rhinoptera bonansus*	34, 35, 250, 340, 341. Schwartz.
Shortnose sturgeon *Acipenser brevirostrum*	34, 132, 201, 341, 581, 654. O'Dell.
Atlantic sturgeon *Acipenser oxyrhynchus*	34, 201, 287, 341, 581, 654. O'Dell.
American eel *Anguilla rostrata*	34, 148, 170, 341, 462, 581, 654. Wiley.
Blueback herring *Alosa aestivalis*	34, 196, 287, 341, 462, 464, 581, 654. O'Dell.
Alewife *Alosa pseudoharengus*	34, 173, 196, 250, 287, 340, 341, 462, 464, 581, 654. O'Dell.
American shad *Alosa sapidissima*	34, 196, 250, 287, 341, 367, 378, 653, 654. O'Dell.
Atlantic menhaden *Brevoortia tyrannus*	34, 196, 250, 287, 341, 574, 581, 653. Houde.
Atlantic herring *Clupea harengus*	34, 287, 297. Field.
Bay anchovy *Anchoa mitchilli*	34, 196, 250, 287, 341, 459, 462, 581. Houde.
Channel catfish *Ictalurus punctatus*	250, 287, 341, 462, 581, 653. O'Dell.
Rainbow smelt *Osmerus mordax*	70. Field.
Atlantic salmon *Salmo salar*	34, 135. Field.
Atlantic cod *Gadus morhua*	34, 230, 250, 341, 647, 653. Lippson.
Haddock *Melanogrammus aeglefinus*	34, 230, 250, 341, 647. Lippson.
Atlantic tomcod *Microgadus tomcod*	34, 230, 665. Field.
Pollock *Pollachius virens*	230, 250, 341. Lippson.
Red hake *Urophycis chuss*	34, 230. Lippson.

Numbers correspond to references listed in Appendix 4, pp. 245-280.
Names correspond to individuals listed in Appendix 3, pp. 239-243.

Species	Choptank River, continued
Oyster toadfish *Opsanus tau*	250, 341, 390, 462, 581. Carter, Gemignani, Jordan, Mihursky, Uphoff.
Sheepshead minnow *Cyprinodon variegatus*	230, 250, 341, 462, 581. Hershfield.
Killifishes *Fundulus* species	7, 230, 250, 341, 462, 581. Hershfield.
Silversides *Menidia* species	174, 250, 341, 581. Carter, Gemignani, Jordan, Mihursky, Schwartz, Uphoff.
Northern pipefish *Syngnathus fuscus*	230, 250, 330, 341, 462, 581. Carter, Gemignani, Jordan, Mihursky, Uphoff.
Northern searobin *Prionotus carolinus*	195. Carter, Gemignani, Mihursky, Uphoff.
White perch *Morone americana*	90, 196, 231, 658. Houde.
Striped bass *Morone saxatilis*	176, 196, 231, 250, 341, 581, 653, 654, 690. Houde.
Black sea bass *Centropristis striata*	231, 250, 341, 436, 581, 653. Lippson.
Yellow perch *Perca flavescens*	90, 159, 160, 161, 196, 231, 250, 341, 462, 491, 653, 654. O'Dell.
Bluefish *Pomatomus saltatrix*	231, 250, 298, 341, 537, 581, 653, 702, 735. Carter, Gemignani, Mihursky, Uphoff.
Pinfish *Lagodon rhomboides*	250, 285, 341, 465. Lippson.
Scup *Stenotomus chrysops*	285. Lippson.
Spotted seatrout *Cynoscion nebulosus*	250, 284, 285, 340, 341, 462, 581, 653. Carter, Gemignani, Mihursky, Stagg, Uphoff.
Weakfish *Cynoscion regalis*	155, 250, 285, 341, 435, 581, 653. Carter, Gemignani, Mihursky, Stagg, Uphoff.
Spot *Leiostomus xanthurus*	250, 285, 341, 462, 533, 581, 653. Wiley.
Northern kingfish *Menticirrhus saxatilis*	285. Lippson.
Atlantic croaker *Micropogonias undulatus*	250, 285, 341, 581, 653. Carter, Gemignani, Jordan, Mihursky, Uphoff.
Black drum *Pogonias cromis*	250, 285, 341, 581, 653, 671. Lippson.
Red drum *Sciaenops ocellatus*	250, 285, 341, 552, 581, 653. Lippson.
Mullets *Mugil* species	107, 108, 250, 341, 390, 581. Lippson.
Tautog *Tautoga onitis*	19, 195, 250, 340, 341, 581, 653. Lippson.
Cunner *Tautogolabrus adspersus*	19, 195. Lippson.
American sand lance *Ammodytes americanus*	20, 195, 250, 341. Lippson.
Gobies *Gobiosoma* species	50, 136, 195, 341, 621. Breitburg.
Atlantic mackerel *Scomber scombrus*	195, 250, 341, 616. Lippson.
Butterfish *Peprilus triacanthus*	250, 341, 390. Lippson.
Summer flounder *Paralichthys dentatus*	200, 210, 250, 341, 390, 573, 581, 653. Stagg.
Windowpane flounder *Scophthalmus aquousus*	250, 341, 390. Carter, Gemignani, Jordan, Mihursky, Uphoff.
Winter flounder *Pleuronectes americanus*	210, 250, 341, 390, 581, 653. Carter, Gemignani, Jordan, Mihursky, Uphoff.
Hogchoker *Trinectes maculatus*	250, 341, 390, 462, 581. Wiley.

Numbers correspond to references listed in Appendix 4, pp. 245-280.
Names correspond to individuals listed in Appendix 3, pp. 239-243.

Appendix 2, continued. Table of references and personal communications

Species	Patuxent River
Blue mussel *Mytilus edulis*	340, 341, 474. Lippson.
Bay scallop *Argopecten irradians*	175, 340, 341. Lippson.
American oyster *Crassostrea virginica*	31, 196, 316, 340, 341, 661. Newell.
Northern quahog *Mercenaria mercenaria*	196, 340, 341, 657, 659. Lippson.
Softshell clam *Mya arenaria*	8, 196, 340, 341, 472. Kennedy.
Brown shrimp *Peneaus aztecus*	324, 340, 341, 746. Lippson.
Daggerblade grass shrimp *Palaemonetes pugio*	14, 340, 341, 746. Van Heukelem.
Sevenspine bay shrimp *Crangon septemspinosa*	340, 341, 746. A.B. Williams.
American lobster *Homarus americanus*	250, 366, 746. Lippson.
Blue crab *Callinectes sapidus*	196, 253, 340, 341, 745, 746. Van Heukelem.
Skates *Raja* species	34, 35, 250, 341. Schwartz.
Atlantic stingray *Dasyatus sabina*	35, 250, 340, 341. Schwartz.
Cownose ray *Rhinoptera bonansus*	34, 35, 340, 341, 637. Schwartz.
Shortnose sturgeon *Acipenser brevirostrum*	34, 132, 201. O'Dell.
Atlantic sturgeon *Acipenser oxyrhynchus*	34, 201, 287. O'Dell.
American eel *Anguilla rostrata*	34, 148, 170, 250, 340, 341. Wiley.
Blueback herring *Alosa aestivalis*	34, 196, 287, 464, 489, 490. O'Dell.
Alewife *Alosa pseudoharengus*	34, 173, 196, 287, 464, 489, 490. O'Dell.
American shad *Alosa sapidissima*	34, 196, 287, 367, 378, 489, 490. O'Dell.
Atlantic menhaden *Brevoortia tyrannus*	34, 196, 287, 574, 250, 340, 341. Houde.
Atlantic herring *Clupea harengus*	34, 287, 297. Field.
Bay anchovy *Anchoa mitchilli*	34, 196, 250, 287, 340, 341, 459. Houde.
Channel catfish *Ictalurus punctatus*	287, 340, 341. O'Dell.
Rainbow smelt *Osmerus mordax*	70. Field.
Atlantic salmon *Salmo salar*	34, 135. Field.
Atlantic cod *Gadus morhua*	34, 230, 250, 341, 647. Lippson.
Haddock *Melanogrammus aeglefinus*	34, 230, 250, 341, 647. Lippson.
Atlantic tomcod *Microgadus tomcod*	34, 230, 665. Field.
Pollock *Pollachius virens*	230, 250, 341. Lippson.
Red hake *Urophycis chuss*	34, 230. Lippson.

Numbers correspond to references listed in Appendix 4, pp. 245-280.
Names correspond to individuals listed in Appendix 3, pp. 239-243.

Species	Patuxent River, continued
Oyster toadfish *Opsanus tau*	340, 341, 390. Carter, Gemignani, Jordan, Mihursky, Uphoff.
Sheepshead minnow *Cyprinodon variegatus*	230, 250, 340, 341. Hershfield.
Killifishes *Fundulus* species	7, 230, 250, 340, 341. Hershfield.
Silversides *Menidia* species	174, 250, 340, 341. Carter, Gemignani, Jordan, Mihursky, Schwartz, Uphoff.
Northern pipefish *Syngnathus fuscus*	230, 250, 330, 340, 341. Carter, Gemignani, Jordan, Mihursky, Uphoff.
Northern searobin *Prionotus carolinus*	195, 250, 341. Carter, Gemignani, Mihursky, Uphoff.
White perch *Morone americana*	196, 231, 489, 490, 658. Houde.
Striped bass *Morone saxatilis*	176, 196, 231, 489, 490, 581. Houde.
Black sea bass *Centropristis striata*	231, 341, 436, 469. Lippson.
Yellow perch *Perca flavescens*	159, 160, 161, 196, 231, 489, 490. O'Dell.
Bluefish *Pomatomus saltatrix*	231, 298, 341, 537, 702, 735. Carter, Gemignani, Mihursky, Uphoff.
Pinfish *Lagodon rhomboides*	250, 285, 341, 465. Lippson.
Scup *Stenotomus chrysops*	250, 285, 341. Lippson.
Spotted seatrout *Cynoscion nebulosus*	284, 285, 341. Carter, Gemignani, Mihursky, Stagg, Uphoff.
Weakfish *Cynoscion regalis*	155, 250, 285, 340, 341, 435. Carter, Gemignani, Mihursky, Stagg, Uphoff.
Spot *Leiostomus xanthurus*	285, 341, 533. Wiley.
Northern kingfish *Menticirrhus saxatilis*	285, 340, 341. Lippson.
Atlantic croaker *Micropogonias undulatus*	285, 341. Carter, Gemignani, Jordan, Mihursky, Uphoff.
Black drum *Pogonias cromis*	285, 341, 671. Lippson.
Red drum *Sciaenops ocellatus*	285, 340, 341, 353, 379, 552. Lippson.
Mullets *Mugil* species	107, 108, 340, 341, 390. Lippson.
Tautog *Tautoga onitis*	19, 195, 340, 341. Lippson.
Cunner *Tautogolabrus adspersus*	19, 195. Lippson.
American sand lance *Ammodytes americanus*	20, 195, 250, 341. Lippson.
Gobies *Gobiosoma* species	50, 136, 195, 340, 341, 621. Breitburg.
Atlantic mackerel *Scomber scombrus*	195, 250, 341, 616. Lippson.
Butterfish *Peprilus triacanthus*	250, 341, 390. Lippson.
Summer flounder *Paralichthys dentatus*	200, 210, 341, 390, 573. Stagg.
Windowpane flounder *Scophthalmus aquousus*	250, 251, 341, 390. Carter, Gemignani, Jordan, Mihursky, Uphoff.
Winter flounder *Pleuronectes americanus*	210, 250, 340, 341, 390. Carter, Gemignani, Jordan, Mihursky, Uphoff.
Hogchoker *Trinectes maculatus*	250, 340, 341, 390. Wiley.

Numbers correspond to references listed in Appendix 4, pp. 245-280.
Names correspond to individuals listed in Appendix 3, pp. 239-243.

Appendix 2, continued. Table of references and personal communications

Species	Potomac River
Blue mussel *Mytilus edulis*	340, 341, 474. Lippson.
Bay scallop *Argopecten irradians*	175, 340, 341, 727. Lippson.
American oyster *Crassostrea virginica*	31, 196, 237, 316, 340, 341, 661, 727. Newell.
Northern quahog *Mercenaria mercenaria*	196, 340, 341, 657, 659, 727. Lippson.
Softshell clam *Mya arenaria*	8, 196, 237, 340, 341, 472, 526, 529, 727. Kennedy.
Brown shrimp *Peneaus aztecus*	324, 340, 746. Lippson.
Daggerblade grass shrimp *Palaemonetes pugio*	14, 311, 339, 340, 528, 746, 753. Van Heukelem.
Sevenspine bay shrimp *Crangon septemspinosa*	340, 341, 746. A.B. Williams.
American lobster *Homarus americanus*	250, 340, 341, 366, 727, 746. Lippson.
Blue crab *Callinectes sapidus*	196, 253, 339, 340, 343, 685, 696, 707, 727, 745, 746. Van Heukelem.
Skates *Raja* species	34, 35, 340, 341. Schwartz.
Atlantic stingray *Dasyatus sabina*	35, 340, 341. Schwartz.
Cownose ray *Rhinoptera bonansus*	34, 35, 340, 606, 636, 637. Schwartz.
Shortnose sturgeon *Acipenser brevirostrum*	34, 132, 201, 340, 727. O'Dell.
Atlantic sturgeon *Acipenser oxyrhynchus*	34, 201, 287, 340, 727. O'Dell.
American eel *Anguilla rostrata*	34, 148, 170, 339, 340, 604, 727. Wiley.
Blueback herring *Alosa aestivalis*	34, 196, 287, 340, 353, 377, 446, 464, 610, 727. O'Dell.
Alewife *Alosa pseudoharengus*	34, 173, 196, 287, 340, 353, 377, 464, 446, 610, 727. O'Dell.
American shad *Alosa sapidissima*	34, 287, 340, 367, 377, 378, 493, 610, 727, 747, 748, 749. O'Dell.
Atlantic menhaden *Brevoortia tyrannus*	34, 287, 292, 340, 478, 574, 727, 748. Houde.
Atlantic herring *Clupea harengus*	34, 287, 297, 340, 727. Field.
Bay anchovy *Anchoa mitchilli*	34, 153, 287, 339, 340, 353, 392, 459. Houde.
Channel catfish *Ictalurus punctatus*	287, 340. O'Dell.
Rainbow smelt *Osmerus mordax*	70, 340, 727. Field.
Atlantic salmon *Salmo salar*	34, 135, 340. Field.
Atlantic cod *Gadus morhua*	34, 230, 250, 340, 341, 647, 727. Lippson.
Haddock *Melanogrammus aeglefinus*	34, 230, 250, 340, 341, 647, 727. Lippson.
Atlantic tomcod *Microgadus tomcod*	34, 230, 340, 665, 727. Field.
Pollock *Pollachius virens*	230, 250, 340, 341, 727. Lippson.
Red hake *Urophycis chuss*	34, 230, 340, 727. Lippson.

Numbers correspond to references listed in Appendix 4, pp. 245-280.
Names correspond to individuals listed in Appendix 3, pp. 239-243.

Species	Potomac River, continued
Oyster toadfish *Opsanus tau*	340, 390. Carter, Gemignani, Jordan, Mihursky, Uphoff.
Sheepshead minnow *Cyprinodon variegatus*	184, 230, 340, 353, 607. Hershfield.
Killifishes *Fundulus* species	7, 184, 230, 340, 353, 607. Hershfield.
Silversides *Menidia* species	174, 340, 353, 492, 610. Carter, Gemignani, Jordan, Mihursky, Schwartz, Uphoff.
Northern pipefish *Syngnathus fuscus*	153, 230, 330, 340, 342, 493, 633. Carter, Gemignani, Jordan, Mihursky, Uphoff.
Northern searobin *Prionotus carolinus*	195, 340, 467, 633. Carter, Gemignani, Mihursky, Uphoff.
White perch *Morone americana*	196, 231, 340, 353, 391, 392, 658, 727. Houde.
Striped bass *Morone saxatilis*	176, 196, 225, 231, 340, 353, 581, 610, 727, 747, 748, 749. Houde.
Black sea bass *Centropristis striata*	231, 340, 436. Lippson.
Yellow perch *Perca flavescens*	159, 160, 161, 196, 231, 340, 491. O'Dell.
Bluefish *Pomatomus saltatrix*	231, 298, 340, 537, 702, 727, 735. Carter, Gemignani, Mihursky, Uphoff.
Pinfish *Lagodon rhomboides*	250, 285, 340, 341, 465. Lippson.
Scup *Stenotomus chrysops*	285, 340, 727. Lippson.
Spotted seatrout *Cynoscion nebulosus*	155, 284, 285, 340, 353, 392. Carter, Gemignani, Mihursky, Stagg, Uphoff.
Weakfish *Cynoscion regalis*	155, 285, 340, 353, 392, 435, 727. Carter, Gemignani, Mihursky, Stagg, Uphoff.
Spot *Leiostomus xanthurus*	285, 340, 342, 353, 467, 513, 533, 610, 727. Wiley.
Northern kingfish *Menticirrhus saxatilis*	285, 340. Lippson.
Atlantic croaker *Micropogonias undulatus*	155, 285, 340, 341, 353, 392. Carter, Gemignani, Jordan, Mihursky, Uphoff.
Black drum *Pogonias cromis*	285, 340, 341, 353, 379, 671. Lippson.
Red drum *Sciaenops ocellatus*	285, 340, 353, 379, 552. Lippson.
Mullets *Mugil* species	250, 340, 341. Lippson.
Tautog *Tautoga onitis*	19, 195, 340, 341, 727. Lippson.
Cunner *Tautogolabrus adspersus*	19, 195, 340. Lippson.
American sand lance *Ammodytes americanus*	20, 195, 250, 340, 341. Lippson.
Gobies *Gobiosoma* species	50, 136, 153, 195, 340, 341, 621. Breitburg.
Atlantic mackerel *Scomber scombrus*	195, 250, 340, 341, 616, 727. Lippson.
Butterfish *Peprilus triacanthus*	250, 340, 341, 390, 478, 727. Lippson.
Summer flounder *Paralichthys dentatus*	200, 210, 250, 340, 359, 390, 478, 573, 610, 727. Stagg.
Windowpane flounder *Scophthalmus aquousus*	250, 340, 341, 390, 727. Carter, Gemignani, Jordan, Mihursky, Uphoff.
Winter flounder *Pleuronectes americanus*	210, 314, 315, 340, 341, 342, 390, 727. Carter, Gemignani, Jordan, Mihursky, Uphoff.
Hogchoker *Trinectes maculatus*	340, 341, 390. Wiley.

Numbers correspond to references listed in Appendix 4, pp. 245-280.
Names correspond to individuals listed in Appendix 3, pp. 239-243.

Appendix 2, continued. Table of references and personal communications

Species	Tangier / Pocomoke Sound
Blue mussel *Mytilus edulis*	340, 341, 474, 653. Lippson.
Bay scallop *Argopecten irradians*	175, 340, 341, 653. Lippson.
American oyster *Crassostrea virginica*	31, 196, 316, 341, 653, 661. Newell.
Northern quahog *Mercenaria mercenaria*	196, 340, 341, 653, 657, 659. Lippson.
Softshell clam *Mya arenaria*	8, 196, 237, 340, 341, 472, 653. Kennedy.
Brown shrimp *Peneaus aztecus*	324, 746. Lippson.
Daggerblade grass shrimp *Palaemonetes pugio*	14, 340, 341, 746. Van Heukelem.
Sevenspine bay shrimp *Crangon septemspinosa*	340, 341, 746. A.B. Williams.
American lobster *Homarus americanus*	341, 366, 746. Lippson.
Blue crab *Callinectes sapidus*	196, 253, 341, 653, 745, 746. Van Heukelem.
Skates *Raja* species	34, 35, 250, 340, 341. Schwartz.
Atlantic stingray *Dasyatus sabina*	35. Schwartz.
Cownose ray *Rhinoptera bonansus*	34, 35, 250, 340, 341, 636. Schwartz.
Shortnose sturgeon *Acipenser brevirostrum*	34, 132, 201, 250, 341. O'Dell.
Atlantic sturgeon *Acipenser oxyrhynchus*	34, 201, 287, 250, 341. O'Dell.
American eel *Anguilla rostrata*	34, 148, 170, 250, 341, 462, 581, 653. Wiley.
Blueback herring *Alosa aestivalis*	34, 196, 250, 287, 341, 464, 581, 653. O'Dell.
Alewife *Alosa pseudoharengus*	34, 173, 196, 250, 287, 341, 464, 581, 653. O'Dell.
American shad *Alosa sapidissima*	34, 196, 250, 287, 341, 367, 378, 581, 653. O'Dell.
Atlantic menhaden *Brevoortia tyrannus*	34, 196, 250, 287, 340, 341, 574, 581, 653. Houde.
Atlantic herring *Clupea harengus*	34, 287, 297. Field.
Bay anchovy *Anchoa mitchilli*	34, 196, 250, 287, 341, 459, 581. Houde.
Channel catfish *Ictalurus punctatus*	250, 287, 341, 581, 653. O'Dell.
Rainbow smelt *Osmerus mordax*	70. Field.
Atlantic salmon *Salmo salar*	34, 135. Field.
Atlantic cod *Gadus morhua*	34, 230, 250, 341, 647. Lippson.
Haddock *Melanogrammus aeglefinus*	34, 230, 647. Lippson.
Atlantic tomcod *Microgadus tomcod*	34, 230, 665. Field.
Pollock *Pollachius virens*	230. Lippson.
Red hake *Urophycis chuss*	34, 230, 250, 341. Lippson.

Numbers correspond to references listed in Appendix 4, pp. 245-280.
Names correspond to individuals listed in Appendix 3, pp. 239-243.

Species	Tangier / Pocomoke Sound, continued
Oyster toadfish *Opsanus tau*	250, 340, 341, 390. Carter, Gemignani, Jordan, Mihursky, Uphoff.
Sheepshead minnow *Cyprinodon variegatus*	230. Hershfield.
Killifishes *Fundulus* species	7, 230. Hershfield.
Silversides *Menidia* species	174, 250, 340, 341, 581. Carter, Gemignani, Jordan, Mihursky, Schwartz, Uphoff.
Northern pipefish *Syngnathus fuscus*	230, 250, 330, 340, 341, 581. Carter, Gemignani, Jordan, Mihursky, Uphoff.
Northern searobin *Prionotus carolinus*	195, 250, 340, 341. Carter, Gemignani, Mihursky, Uphoff.
White perch *Morone americana*	196, 231, 250, 341, 581, 653, 658. Houde.
Striped bass *Morone saxatilis*	176, 196, 231, 250, 341, 581, 653. Houde.
Black sea bass *Centropristis striata*	231, 250, 341, 436, 581, 653. Lippson.
Yellow perch *Perca flavescens*	159, 160, 161, 196, 231, 250, 340, 341, 491, 653. O'Dell.
Bluefish *Pomatomus saltatrix*	231, 298, 340, 341, 537, 581, 653, 702, 735. Carter, Gemignani, Mihursky, Uphoff.
Pinfish *Lagodon rhomboides*	250, 285, 340, 341, 465, 653. Lippson.
Scup *Stenotomus chrysops*	250, 285, 340, 341, 653. Lippson.
Spotted seatrout *Cynoscion nebulosus*	284, 285, 340, 341, 581, 653. Carter, Gemignani, Mihursky, Stagg, Uphoff.
Weakfish *Cynoscion regalis*	155, 285, 340, 341, 435, 581, 653. Carter, Gemignani, Mihursky, Stagg, Uphoff.
Spot *Leiostomus xanthurus*	285, 340, 341, 533, 581, 653. Wiley.
Northern kingfish *Menticirrhus saxatilis*	250, 285, 341, 478, 653. Lippson.
Atlantic croaker *Micropogonias undulatus*	250, 285, 340, 341, 653. Carter, Gemignani, Jordan, Mihursky, Uphoff.
Black drum *Pogonias cromis*	285, 340, 341, 653, 671. Lippson.
Red drum *Sciaenops ocellatus*	285, 340, 341, 552, 581, 653. Lippson.
Mullets *Mugil* species	107, 108, 250, 340, 341, 390, 653. Lippson.
Tautog *Tautoga onitis*	19, 195, 250, 340, 341, 581, 653. Lippson.
Cunner *Tautogolabrus adspersus*	19, 195. Lippson.
American sand lance *Ammodytes americanus*	20, 195. Lippson.
Gobies *Gobiosoma* species	50, 136, 195, 341. Breitburg.
Atlantic mackerel *Scomber scombrus*	195, 250, 341, 616. Lippson.
Butterfish *Peprilus triacanthus*	250, 341, 390. Lippson.
Summer flounder *Paralichthys dentatus*	200, 210, 340, 341, 390, 573, 581, 653. Stagg.
Windowpane flounder *Scophthalmus aquousus*	250, 340, 341, 390. Carter, Gemignani, Jordan, Mihursky, Uphoff.
Winter flounder *Pleuronectes americanus*	210, 340, 341, 390, 581, 653. Carter, Gemignani, Jordan, Mihursky, Uphoff.
Hogchoker *Trinectes maculatus*	250, 340, 341, 390. Wiley.

Numbers correspond to references listed in Appendix 4, pp. 245-280.
Names correspond to individuals listed in Appendix 3, pp. 239-243.

Appendix 2, continued. Table of references and personal communications

Species	Rappahannock River
Blue mussel *Mytilus edulis*	341, 474, 708. Barber, Newell.
Bay scallop *Argopecten irradians*	175, 587, 708. Barber, Dupaul.
American oyster *Crassostrea virginica*	21, 196, 341, 661, 708, 730. Barber, Newell.
Northern quahog *Mercenaria mercenaria*	196, 341, 657, 708. Barber.
Softshell clam *Mya arenaria*	8, 196, 341, 708. Barber, Kennedy.
Brown shrimp *Peneaus aztecus*	324, 708, 746. Lipcius.
Daggerblade grass shrimp *Palaemonetes pugio*	14, 341, 708, 746. Lipcius, Van Heukelem.
Sevenspine bay shrimp *Crangon septemspinosa*	708, 746. Lipcius.
American lobster *Homarus americanus*	366, 708, 746. Lipcius, Olney.
Blue crab *Callinectes sapidus*	196, 198, 199, 253, 341, 708, 745, 746. Gibbs, Lipcius, Van Heukelem.
Skates *Raja* species	34, 35, 251, 341, 396, 413, 414, 708. Branstetter, Sminkey, Tabbit.
Atlantic stingray *Dasyatus sabina*	35, 251, 341, 396, 608, 708. Branstetter, Sminkey, Tabbit.
Cownose ray *Rhinoptera bonansus*	34, 35, 251, 341, 396, 635, 636, 637, 708. Branstetter, Sminkey, Tabbit.
Shortnose sturgeon *Acipenser brevirostrum*	34, 132, 201, 251, 341, 396, 708. Colvocoresses, Seaver, Estes.
Atlantic sturgeon *Acipenser oxyrhynchus*	34, 201, 251, 287, 341, 396, 708. Colvocoresses, Seaver, Estes.
American eel *Anguilla rostrata*	34, 170, 251, 341, 396, 708, 724. Wiley, Olney, Colvocoresses.
Blueback herring *Alosa aestivalis*	30, 34, 42, 43, 145, 173, 196, 198, 199, 251, 287, 307, 317, 341, 346, 347, 348, 349, 396, 464, 708. Dixon, Loesch.
Alewife *Alosa pseudoharengus*	34, 42, 43, 74, 75, 145, 173, 196, 198, 199, 251, 287, 307, 317, 341, 346, 347, 348, 349, 396, 464, 344, 686, 708. Dixon, Loesch.
American shad *Alosa sapidissima*	34, 42, 43, 145, 196, 198, 199, 251, 287, 317, 318, 341, 346, 347, 348, 349, 367, 394, 396, 708. Dixon, Loesch.
Atlantic menhaden *Brevoortia tyrannus*	34, 196, 198, 199, 251, 287, 307, 341, 396, 397, 410, 418, 496, 574, 708. Olney, Houde, Desfosse, Lucy.
Atlantic herring *Clupea harengus*	34, 198, 199, 251, 287, 297, 341, 396, 708. Colvocoresses, Seaver, Estes.
Bay anchovy *Anchoa mitchilli*	34, 152, 196, 198, 199, 251, 287, 307, 341, 358, 396, 459, 619, 687, 708. Colvocoresses, Houde, Luo.
Channel catfish *Ictalurus punctatus*	198, 199, 251, 287, 307, 341, 396, 708, 719. Colvocoresses, Estes, Seaver.
Rainbow smelt *Osmerus mordax*	70, 198, 199, 230, 251, 341, 396, 515, 698, 708. Colvocoresses.
Atlantic salmon *Salmo salar*	34, 135, 198, 199, 251, 341, 396, 515, 698, 708. Colvocoresses.
Atlantic cod *Gadus morhua*	198, 199, 230, 251, 341, 396, 515, 647, 698, 708. Colvocoresses, Olney.
Haddock *Melanogrammus aeglefinus*	198, 199, 230, 251, 341, 396, 515, 647, 698, 708. Colvocoresses.
Atlantic tomcod *Microgadus tomcod*	198, 199, 230, 251, 341, 396, 515, 665, 698, 708. Colvocoresses.
Pollock *Pollachius virens*	198, 199, 230, 251, 341, 396, 515, 698, 708. Colvocoresses, Olney.
Red hake *Urophycis chuss*	34, 198, 199, 230, 251, 307, 341, 396, 708. Colvocoresses, Olney.

Numbers correspond to references listed in Appendix 4, pp. 245-280.
Names correspond to individuals listed in Appendix 3, pp. 239-243.

Species	Rappahannock River, continued
Oyster toadfish *Opsanus tau*	198, 199, 251, 341, 390, 396, 708. Carter, Colvocoresses, Estes, Seaver.
Sheepshead minnow *Cyprinodon variegatus*	230, 251, 341, 396, 708. Carmichael, Colvocoresses, Estes, Gear, Seaver, Weisberg.
Killifishes *Fundulus* species	7, 230, 251, 341, 396, 708. Carmichael, Colvocoresses, Estes, Gear, Seaver, Weisberg.
Silversides *Menidia* species	174, 251, 307, 341, 396, 708. Colvocoresses, Estes, Gear, Seaver.
Northern pipefish *Syngnathus fuscus*	230, 251, 330, 341, 396, 708. Carter, Colvocoresses, Gear.
Northern searobin *Prionotus carolinus*	195, 198, 199, 251, 341, 396, 708. Carter, Chittenden, Estes, Seaver, Uphoff.
White perch *Morone americana*	196, 198, 199, 231, 251, 307, 317, 341, 396, 619, 652, 658, 708. Colvocoresses, Houde, Olney.
Striped bass *Morone saxatilis*	176, 196, 198, 199, 231, 251, 310, 317, 341, 396, 503, 652, 684, 708. Colvocoresses, Houde, Olney.
Black sea bass *Centropristis striata*	198, 199, 231, 251, 341, 396, 436, 708. Colvocoresses, Gear.
Yellow perch *Perca flavescens*	196, 198, 199, 231, 251, 307, 341, 396, 708. Colvocoresses, Estes, Gear, Seaver.
Bluefish *Pomatomus saltatrix*	231, 251, 298, 341, 396, 537, 708. Colvocoresses, Olney, Uphoff.
Pinfish *Lagodon rhomboides*	198, 199, 251, 285, 341, 396, 465, 708. Colvocoresses, Estes, Gear, Seaver.
Scup *Stenotomus chrysops*	198, 199, 251, 285, 341, 396, 708. Colvocoresses, Lippson, Olney.
Spotted seatrout *Cynoscion nebulosus*	198, 199, 251, 284, 285, 341, 396, 708. Chittenden, Stagg, Uphoff.
Weakfish *Cynoscion regalis*	198, 199, 251, 285, 341, 396, 435, 609, 708. Chittenden, Lowerre, Olney, Stagg, Uphoff.
Spot *Leiostomus xanthurus*	198, 199, 251, 285, 307, 341, 396, 533, 708. Chittenden, Olney, Wiley, C.D. Williams.
Northern kingfish *Menticirrhus saxatilis*	198, 199, 251, 285, 341, 396, 708. Chittenden, Colvocoresses, Olney.
Atlantic croaker *Micropogonias undulatus*	198, 199, 251, 285, 341, 396, 480, 483, 708. Barbieri, Carter, Chittenden, Olney.
Black drum *Pogonias cromis*	190, 198, 199, 251, 285, 341, 396, 671, 708. Chittenden, Lippson, Olney.
Red drum *Sciaenops ocellatus*	198, 199, 251, 285, 341, 396, 552, 708. Cavaluzzi, Chittenden, Lippson, Olney.
Mullets *Mugil* species	107, 108, 198, 199, 251, 341, 390, 396, 708. Colvocoresses, Estes, Gear, Seaver.
Tautog *Tautoga onitis*	19, 195, 198, 199, 251, 341, 396, 708. Colvocoresses, Estes, Seaver.
Cunner *Tautogolabrus adspersus*	19, 195, 198, 199, 251, 341, 396, 708. Colvocoresses.
American sand lance *Ammodytes americanus*	20, 195, 251, 341, 708. Colvocoresses, Estes, Seaver.
Gobies *Gobiosoma* species	50, 136, 195, 251, 341, 396, 708. Breitburg, Colvocoresses, Estes, Seaver.
Atlantic mackerel *Scomber scombrus*	195, 198, 199, 251, 341, 396, 708. Chittenden, Colvocoresses, Olney.
Butterfish *Peprilus triacanthus*	198, 199, 251, 341, 390, 396, 708. Colvocoresses, Estes, Gear, Seaver.
Summer flounder *Paralichthys dentatus*	198, 199, 200, 210, 251, 341, 390, 396, 573, 708. Desfosse, Gear, Musick, Olney.
Windowpane flounder *Scophthalmus aquousus*	198, 199, 251, 341, 390, 396, 698, 708. Carter, Desfosse, Musick, Olney.
Winter flounder *Pleuronectes americanus*	198, 199, 210, 251, 341, 390, 396, 708. Carter, Desfosse, Musick, Olney.
Hogchoker *Trinectes maculatus*	198, 199, 251, 341, 390, 396, 708. Carter, Colvocoresses, Estes, Seaver, Wiley.

Numbers correspond to references listed in Appendix 4, pp. 245-280.
Names correspond to individuals listed in Appendix 3, pp. 239-243.

Appendix 2, continued. Table of references and personal communications

Species	York River
Blue mussel *Mytilus edulis*	341, 474, 708. Barber, Newell.
Bay scallop *Argopecten irradians*	175, 587, 708. Barber, Dupaul.
American oyster *Crassostrea virginica*	21, 196, 341, 568, 569, 661, 708. Barber, M.P. Lynch, Newell.
Northern quahog *Mercenaria mercenaria*	196, 341, 657, 708. Barber.
Softshell clam *Mya arenaria*	8, 196, 341, 355, 708. Barber, Kennedy.
Brown shrimp *Peneaus aztecus*	324, 708, 746. Lipcius.
Daggerblade grass shrimp *Palaemonetes pugio*	14, 341, 708, 746. Lipcius, Van Heukelem.
Sevenspine bay shrimp *Crangon septemspinosa*	708, 221, 746. Lipcius.
American lobster *Homarus americanus*	366, 708, 746. Lipcius, Olney.
Blue crab *Callinectes sapidus*	196, 198, 199, 253, 338, 341, 442, 588, 708, 745, 746. Gibbs, Lipcius, Van Heukelem.
Skates *Raja* species	34, 35, 251, 341, 413, 414, 698, 708. Branstetter, Sminkey, Tabbit.
Atlantic stingray *Dasyatus sabina*	35, 251, 341, 608, 698, 708. Branstetter, Sminkey, Tabbit.
Cownose ray *Rhinoptera bonansus*	34, 35, 251, 341, 635, 636, 637, 698, 708. Branstetter, Sminkey, Tabbit.
Shortnose sturgeon *Acipenser brevirostrum*	34, 132, 201, 251, 341, 698, 708. Colvocoresses, Seaver, Estes.
Atlantic sturgeon *Acipenser oxyrhynchus*	34, 201, 251, 287, 341, 698, 708. Colvocoresses, Seaver, Estes.
American eel *Anguilla rostrata*	34, 170, 243, 251, 341, 698, 708, 724. Wiley, Olney, Colvocoresses.
Blueback herring *Alosa aestivalis*	34, 42, 43, 145, 173, 196, 198, 199, 251, 287, 307, 341, 346, 347, 348, 349, 464, 708. Dixon, Loesch.
Alewife *Alosa pseudoharengus*	34, 42, 43, 145, 173, 196, 198, 199, 251, 287, 307, 341, 346, 347, 348, 349, 464, 698, 708. Dixon, Loesch.
American shad *Alosa sapidissima*	34, 42, 43, 145, 196, 198, 199, 251, 287, 318, 341, 346, 347, 348, 349, 367, 394, 698, 708. Dixon, Loesch.
Atlantic menhaden *Brevoortia tyrannus*	34, 196, 287, 574, 198, 199, 251, 341, 307, 187, 189, 397, 418, 496, 698, 708. Olney, Houde, Desfosse, Lucy.
Atlantic herring *Clupea harengus*	34, 198, 199, 251, 287, 297, 341, 698, 708. Colvocoresses, Seaver, Estes.
Bay anchovy *Anchoa mitchilli*	34, 152, 196, 198, 199, 251, 287, 307, 341, 358, 459, 619, 687, 698, 708. Colvocoresses, Houde, Luo.
Channel catfish *Ictalurus punctatus*	198, 199, 251, 287, 307, 341, 698, 708, 719. Colvocoresses, Estes, Seaver.
Rainbow smelt *Osmerus mordax*	70, 198, 199, 230, 251, 341, 396, 515, 698, 708. Colvocoresses.
Atlantic salmon *Salmo salar*	34, 135, 198, 199, 251, 341, 396, 515, 698, 708. Colvocoresses.
Atlantic cod *Gadus morhua*	198, 199, 230, 251, 341, 396, 515, 647, 698, 708. Colvocoresses, Olney.
Haddock *Melanogrammus aeglefinus*	198, 199, 230, 251, 341, 396, 515, 647, 698, 708. Colvocoresses.
Atlantic tomcod *Microgadus tomcod*	198, 199, 230, 251, 341, 396, 515, 665, 698, 708. Colvocoresses.
Pollock *Pollachius virens*	198, 199, 230, 251, 341, 396, 515, 698, 708. Colvocoresses, Olney.
Red hake *Urophycis chuss*	26, 34, 198, 199, 230, 251, 307, 341, 698, 708. Colvocoresses, Olney.

Numbers correspond to references listed in Appendix 4, pp. 245-280.
Names correspond to individuals listed in Appendix 3, pp. 239-243.

Species	York River, continued
Oyster toadfish *Opsanus tau*	198, 199, 251, 341, 390, 698, 708. Carter, Colvocoresses, Estes, Seaver.
Sheepshead minnow *Cyprinodon variegatus*	230, 251, 341, 698, 708. Carmichael, Colvocoresses, Estes, Gear, Seaver, Weisberg.
Killifishes *Fundulus* species	7, 84, 230, 251, 341, 445, 698, 708. Carmichael, Colvocoresses, Estes, Gear, Seaver, Weisberg.
Silversides *Menidia* species	174, 251, 307, 341, 445, 698, 708. Colvocoresses, Estes, Gear, Seaver.
Northern pipefish *Syngnathus fuscus*	230, 251, 330, 341, 434, 698, 708. Carter, Colvocoresses, Gear.
Northern searobin *Prionotus carolinus*	195, 198, 199, 251, 341, 412, 698, 708. Carter, Chittenden, Estes, Seaver, Uphoff.
White perch *Morone americana*	196, 198, 199, 231, 251, 307, 341, 563, 619, 652, 655, 658, 698, 708. Colvocoresses, Houde, Olney.
Striped bass *Morone saxatilis*	119, 176, 179, 196, 198, 199, 206, 231, 251, 310, 341, 503, 563, 652, 684, 698, 708. Colvocoresses, Houde, Olney.
Black sea bass *Centropristis striata*	198, 199, 231, 251, 341, 436, 698, 708. Colvocoresses, Gear.
Yellow perch *Perca flavescens*	196, 198, 199, 231, 251, 341, 698, 708. Colvocoresses, Estes, Gear, Seaver.
Bluefish *Pomatomus saltatrix*	231, 251, 298, 341, 537, 698, 708. Colvocoresses, Olney, Uphoff.
Pinfish *Lagodon rhomboides*	198, 199, 251, 285, 341, 465, 698, 708. Colvocoresses, Estes, Gear, Seaver.
Scup *Stenotomus chrysops*	198, 199, 251, 285, 341, 644, 646, 698, 708. Colvocoresses, Lippson, Olney.
Spotted seatrout *Cynoscion nebulosus*	64, 198, 199, 251, 284, 285, 341, 698, 708. Chittenden, Stagg, Uphoff.
Weakfish *Cynoscion regalis*	92, 113, 198, 199, 251, 285, 341, 399, 435, 609, 612, 698, 708. Chittenden, Lowerre, Olney, Stagg, Uphoff.
Spot *Leiostomus xanthurus*	92, 113, 198, 199, 251, 285, 307, 341, 445, 495, 511, 513, 533, 698, 708. Chittenden, Olney, Wiley, C.D. Williams.
Northern kingfish *Menticirrhus saxatilis*	113, 198, 199, 251, 285, 341, 698, 708. Chittenden, Colvocoresses, Olney.
Atlantic croaker *Micropogonias undulatus*	92, 113, 198, 199, 251, 285, 341, 480, 483, 698, 708. Barbieri, Carter, Chittenden, Olney.
Black drum *Pogonias cromis*	198, 199, 251, 285, 341, 671, 698, 708. Chittenden, Lippson, Olney.
Red drum *Sciaenops ocellatus*	92, 113, 198, 199, 251, 285, 341, 552, 698, 708. Cavaluzzi, Chittenden, Lippson, Olney.
Mullets *Mugil* species	107, 108, 198, 199, 251, 341, 390, 698, 708. Colvocoresses, Estes, Gear, Seaver.
Tautog *Tautoga onitis*	19, 195, 198, 199, 251, 341, 698, 708. Colvocoresses, Estes, Seaver.
Cunner *Tautogolabrus adspersus*	19, 195, 198, 199, 251, 341, 698, 708. Colvocoresses.
American sand lance *Ammodytes americanus*	20, 195, 251, 341, 708. Colvocoresses, Estes, Seaver.
Gobies *Gobiosoma* species	50, 136, 195, 251, 341, 398, 458, 634, 698, 708. Breitburg, Colvocoresses, Estes, Seaver.
Atlantic mackerel *Scomber scombrus*	195, 198, 199, 251, 341, 617, 698, 708. Chittenden, Colvocoresses, Olney.
Butterfish *Peprilus triacanthus*	198, 199, 251, 341, 390, 698, 708. Colvocoresses, Estes, Gear, Seaver.
Summer flounder *Paralichthys dentatus*	198, 199, 200, 210, 251, 341, 390, 573, 698, 708. Desfosse, Gear, Musick, Olney.
Windowpane flounder *Scophthalmus aquousus*	198, 199, 251, 341, 390, 698, 708. Carter, Desfosse, Musick, Olney.
Winter flounder *Pleuronectes americanus*	198, 199, 210, 251, 341, 390, 698, 708. Carter, Desfosse, Musick, Olney.
Hogchoker *Trinectes maculatus*	198, 199, 251, 341, 390, 698, 708. Carter, Colvocoresses, Estes, Seaver, Wiley.

Numbers correspond to references listed in Appendix 4, pp. 245-280.
Names correspond to individuals listed in Appendix 3, pp. 239-243.

Appendix 2, continued. Table of references and personal communications

Species	James River
Blue mussel *Mytilus edulis*	341, 474, 708. Barber, Newell.
Bay scallop *Argopecten irradians*	175, 587, 708. Barber, Dupaul.
American oyster *Crassostrea virginica*	15, 21, 124, 196, 236, 238, 341, 455, 551, 582, 661, 708. Barber, Newell.
Northern quahog *Mercenaria mercenaria*	196, 321, 341, 657, 708. Barber.
Softshell clam *Mya arenaria*	8, 196, 341, 708. Barber, Kennedy.
Brown shrimp *Peneaus aztecus*	708, 746. Lipcius.
Daggerblade grass shrimp *Palaemonetes pugio*	14, 341, 708, 746. Lipcius, Van Heukelem.
Sevenspine bay shrimp *Crangon septemspinosa*	708, 746. Lipcius.
American lobster *Homarus americanus*	366, 708, 746. Lipcius, Olney.
Blue crab *Callinectes sapidus*	196, 198, 199, 253, 341, 708, 745, 746. Gibbs, Lipcius, Van Heukelem.
Skates *Raja* species	34, 35, 251, 341, 413, 414, 708. Branstetter, Sminkey, Tabbit.
Atlantic stingray *Dasyatus sabina*	35, 251, 341, 608, 708. Branstetter, Sminkey, Tabbit.
Cownose ray *Rhinoptera bonansus*	34, 35, 251, 341, 635, 636, 637, 708. Branstetter, Sminkey, Tabbit.
Shortnose sturgeon *Acipenser brevirostrum*	34, 132, 201, 251, 341, 708. Colvocoresses, Seaver, Estes.
Atlantic sturgeon *Acipenser oxyrhynchus*	34, 201, 251, 287, 341, 708. Colvocoresses, Seaver, Estes.
American eel *Anguilla rostrata*	34, 170, 251, 341, 708, 243, 724. Wiley, Olney, Colvocoresses.
Blueback herring *Alosa aestivalis*	34, 42, 43, 74, 75, 145, 173, 196, 198, 199, 251, 287, 307, 341, 346, 347, 348, 349, 464, 683, 708. Dixon, Loesch.
Alewife *Alosa pseudoharengus*	34, 42, 43, 145, 173, 196, 198, 199, 251, 287, 318, 341, 346, 347, 348, 349, 394, 464, 708, 709. Dixon, Loesch.
American shad *Alosa sapidissima*	34, 42, 43, 145, 196, 198, 199, 251, 287, 318, 341, 346, 347, 348, 349, 367, 394, 708. Dixon, Loesch.
Atlantic menhaden *Brevoortia tyrannus*	34, 196, 198, 199, 251, 287, 307, 341, 397, 418, 496, 574, 708. Olney, Houde, Desfosse, Lucy.
Atlantic herring *Clupea harengus*	34, 198, 199, 251, 287, 297, 341, 708. Colvocoresses, Seaver, Estes.
Bay anchovy *Anchoa mitchilli*	34, 79, 152, 196, 198, 199, 251, 287, 307, 341, 358, 459, 619, 687, 708. Colvocoresses, Houde, Luo.
Channel catfish *Ictalurus punctatus*	198, 199, 251, 287, 307, 323, 341, 433, 708, 719. Colvocoresses, Estes, Seaver.
Rainbow smelt *Osmerus mordax*	70, 198, 199, 230, 251, 341, 396, 515, 698, 708. Colvocoresses.
Atlantic salmon *Salmo salar*	34, 135, 198, 199, 251, 341, 396, 515, 698, 708. Colvocoresses.
Atlantic cod *Gadus morhua*	198, 199, 230, 251, 341, 396, 515, 647, 698, 708. Colvocoresses, Olney.
Haddock *Melanogrammus aeglefinus*	198, 199, 230, 251, 341, 396, 515, 647, 698, 708. Colvocoresses.
Atlantic tomcod *Microgadus tomcod*	198, 199, 230, 251, 341, 396, 515, 665, 698, 708. Colvocoresses.
Pollock *Pollachius virens*	198, 199, 230, 251, 341, 396, 515, 698, 708. Colvocoresses, Olney.
Red hake *Urophycis chuss*	26, 34, 198, 199, 230, 251, 307, 341, 708. Colvocoresses, Olney.

Numbers correspond to references listed in Appendix 4, pp. 245-280.
Names correspond to individuals listed in Appendix 3, pp. 239-243.

Species	James River, continued
Oyster toadfish *Opsanus tau*	198, 199, 251, 341, 390, 708. Carter, Colvocoresses, Estes, Seaver.
Sheepshead minnow *Cyprinodon variegatus*	230, 251, 341, 708. Carmichael, Colvocoresses, Estes, Gear, Seaver, Weisberg.
Killifishes *Fundulus* species	7, 230, 251, 341, 708. Carmichael, Colvocoresses, Estes, Gear, Seaver, Weisberg.
Silversides *Menidia* species	77, 174, 251, 307, 341, 708. Colvocoresses, Estes, Gear, Seaver.
Northern pipefish *Syngnathus fuscus*	230, 251, 330, 341, 708. Carter, Colvocoresses, Gear.
Northern searobin *Prionotus carolinus*	195, 198, 199, 251, 341, 412, 708. Carter, Chittenden, Estes, Seaver, Uphoff.
White perch *Morone americana*	196, 198, 199, 231, 251, 307, 341, 619, 652, 655, 656, 658, 708. Colvocoresses, Houde, Olney.
Striped bass *Morone saxatilis*	176, 196, 198, 199, 231, 251, 310, 341, 503, 652, 684, 708. Colvocoresses, Houde, Olney.
Black sea bass *Centropristis striata*	198, 199, 231, 251, 341, 436, 708. Colvocoresses, Gear.
Yellow perch *Perca flavescens*	196, 198, 199, 231, 251, 341, 708. Colvocoresses, Estes, Gear, Seaver.
Bluefish *Pomatomus saltatrix*	231, 251, 298, 341, 537, 708. Colvocoresses, Olney, Uphoff.
Pinfish *Lagodon rhomboides*	198, 199, 251, 285, 341, 465, 708. Colvocoresses, Estes, Gear, Seaver.
Scup *Stenotomus chrysops*	198, 199, 251, 285, 341, 644, 646, 708. Colvocoresses, Lippson, Olney.
Spotted seatrout *Cynoscion nebulosus*	198, 199, 251, 284, 285, 341, 708. Chittenden, Stagg, Uphoff.
Weakfish *Cynoscion regalis*	198, 199, 251, 285, 341, 435, 708. Chittenden, Lowerre, Olney, Stagg, Uphoff.
Spot *Leiostomus xanthurus*	198, 199, 251, 285, 307, 341, 403, 533, 708. Chittenden, Olney, Wiley, C.D. Williams.
Northern kingfish *Menticirrhus saxatilis*	198, 199, 251, 285, 341, 708. Chittenden, Colvocoresses, Olney.
Atlantic croaker *Micropogonias undulatus*	198, 199, 251, 285, 341, 480, 483, 708. Barbieri, Carter, Chittenden, Olney.
Black drum *Pogonias cromis*	190, 198, 199, 251, 285, 341, 671, 708. Chittenden, Lippson, Olney.
Red drum *Sciaenops ocellatus*	198, 199, 251, 285, 341, 552, 708. Cavaluzzi, Chittenden, Lippson, Olney.
Mullets *Mugil* species	107, 108, 198, 199, 251, 341, 390, 708. Colvocoresses, Estes, Gear, Seaver.
Tautog *Tautoga onitis*	19, 195, 198, 199, 251, 341, 708. Colvocoresses, Estes, Seaver.
Cunner *Tautogolabrus adspersus*	19, 195, 198, 199, 251, 341, 708. Colvocoresses.
American sand lance *Ammodytes americanus*	20, 195, 251, 341, 708. Colvocoresses, Estes, Seaver.
Gobies *Gobiosoma* species	50, 136, 195, 251, 341, 708. Breitburg, Colvocoresses, Estes, Seaver.
Atlantic mackerel *Scomber scombrus*	195, 198, 199, 251, 341, 458, 617, 634, 708. Chittenden, Colvocoresses, Olney.
Butterfish *Peprilus triacanthus*	198, 199, 251, 341, 390, 708. Colvocoresses, Estes, Gear, Seaver.
Summer flounder *Paralichthys dentatus*	198, 199, 200, 210, 251, 341, 390, 573, 708. Desfosse, Gear, Musick, Olney.
Windowpane flounder *Scophthalmus aquousus*	198, 199, 251, 341, 390, 708. Carter, Desfosse, Musick, Olney.
Winter flounder *Pleuronectes americanus*	198, 199, 210, 251, 341, 390, 708. Carter, Desfosse, Musick, Olney.
Hogchoker *Trinectes maculatus*	198, 199, 251, 341, 390, 510, 640, 708. Carter, Colvocoresses, Estes, Seaver, Wiley.

Numbers correspond to references listed in Appendix 4, pp. 245-280.
Names correspond to individuals listed in Appendix 3, pp. 239-243.

Appendix 3. Reviewers and personal communications

Name	Affiliation
Anderson, B.N.	Delaware Dept. Natural Resources and Environmental Control, Dover, DE
Barber, B.	Univ. Maine, Dept. Animal, Veterinary, and Aquatic Sciences, Orono, ME
Barbieri, L.R.	Virginia Institute of Marine Science, Gloucester Pt., VA
Beck, S.	Environmental Consulting Services, Inc., Middletown, DE
Branstetter, S.	Virginia Institute of Marine Science, Gloucester Pt., VA
Breitburg, D.L.	Benedict Estuarine Research Lab., Benedict, MD
Briggs, P.T.	New York St. Dept. Environmental Conservation, Stony Brook, NY
Browne, M.	General Public Utilities Nuclear Corp., Forked River, NJ
Brundage, H.M.	Environmental Research and Consulting, Inc., Chadds Ford, PA
Byrne, D.M.	New Jersey Div. Fish, Game, and Wildlife, Port Republic, NJ
Cadrin, S.X.	Massachusetts Div. Marine Fisheries, Sandwich, MA
Carmichael, J.	Maryland Dept. Natural Resources, Annapolis, MD
Carter, W.R., III	Maryland Dept. Natural Resources, Annapolis, MD
Casey, J.F.	Maryland Dept. Natural Resources, Annapolis, MD
Castagna, M.	Virginia Institute of Marine Science, Eastern Shore Lab., Wachapreague, VA
Cavalluzzi, M.	Virginia Institute of Marine Science, Gloucester Pt., VA
Cerrato, R.M.	St. Univ. New York, Marine Sciences Research Center, Stony Brook, NY
Chittenden, M.E., Jr.	Virginia Institute of Marine Science, Gloucester Pt., VA
Cole, R.W.	Delaware Div. Fish and Wildlife, Little Creek, DE
Collings, W.S.	Common Wealth Electric Co., Wareham, MA
Colvocoresses, J.A.	Florida Marine Research Institute, Inglis, FL
Correia, S.J.	Massachusetts Div. Marine Fisheries, Sandwich, MA
Crawford, R.	Waquoit Bay National Estuarine Research Reserve, Waquoit, MA
Currier, T.P.	Massachusetts Div. Marine Fisheries, Sandwich, MA
Daiber, F.C.	Univ. Delaware, Newark, DE
Daniel, L.B.	Virginia Institute of Marine Science, Gloucester Pt., VA

Deegan, L.A.	Marine Biological Lab., Woods Hole, MA
Desfosse, J.C.	Virginia Institute of Marine Science, Gloucester Pt., VA
Dixon, D.	Virginia Institute of Marine Science, Gloucester Pt., VA
Douglason, J.	Univ. Rhode Island, Graduate School of Oceanography, Narragansett, RI
Dunning, D.J.	New York Power Authority, White Plains, NY
Dupaul, W.D.	Virginia Institute of Marine Science, Gloucester Pt., VA
Ephart, S.	Connecticut Dept. Environmental Protection, Marine Fisheries, Waterford, CT
Epifanio, C.E.	Univ. Delaware, College of Marine Studies, Lewes, DE
Estes, D.	Virginia Institute of Marine Science, Gloucester Pt., VA
Estrella, B.T.	Massachusetts Div. Marine Fisheries, Sandwich, MA
Fahay, M.P.	NOAA/NMFS Sandy Hook Lab., Highlands, NJ
Ferraro, S.P.	U.S. EPA, Hatfield Marine Science Center, Newport, OR
Field, J.D.	NOAA/NOS SEA Division, Silver Spring, MD
Figley, W.	New Jersey Div. Fish, Game, and Wildlife, Port Republic, NJ
Fine, M.	Virginia Commonwealth Univ., Richmond, VA
Finn, J.	NOAA/NMFS Sandy Hook Lab., Highlands, NJ
Fox, R.E.	New York St. Dept. Environmental Conservation, Stony Brook, NY
Ganz, A.R.	Rhode Island Div. Fish and Wildlife, Wakefield, RI
Gauthier, C.	Northeast Utilities Environmental Lab., Waterford, CT
Geer, P.J.	Virginia Institute of Marine Science, Gloucester Pt., VA
Gemignani, H.	Anne Arundel Community College, Arnold, MD
Gibbs, D.	Virginia Institute of Marine Science, Gloucester Pt., VA
Goodger, T.	NOAA/NMFS Oxford Lab., Oxford, MD
Halgren, B.A.	New Jersey Div. Fish, Game, and Wildlife, Trenton, NJ
Hamilton, J.	Consolidated Edison Co., New York, NY
Haskin, H.H.	Rutgers Univ., Shellfish Research Lab., Port Norris, NJ
Hattala, K.	New York St. Dept. Environmental Conservation, New Paltz, NY
Hershfield, M.	Chesapeake Bay Foundation, Annapolis, MD

Hickey, J.M.	Massachusetts Div. Marine Fisheries, Sandwich, MA
Houde, E.D.	Univ. Maryland, Chesapeake Biological Lab., Solomons, MD
Howe, A.B.	Massachusetts Div. Marine Fisheries, Sandwich, MA
Howell, P.T.	Connecticut Dept. Environmental Protection, Marine Fisheries, Waterford, CT
Hurley, S.T.	Massachusetts Div. Inland Fisheries and Wildlife, Buzzards Bay, MA
Jacobsen, T.	Rutgers Univ., Shellfish Research Lab., Port Norris, NJ
Jeffries, H.P.	Univ. Rhode Island, Graduate School of Oceanography, Narragansett, RI
Jordan, S.J.	Maryland Dept. Natural Resources, Annapolis, MD
Joseph, J.W.	New Jersey Div. Fish, Game, and Wildlife, Port Republic, NJ
Kassner, J.	Town of Brookhaven, Div. Environmental Protection, Medford, NY
Keller, A.	Univ. Rhode Island, Graduate School of Oceanography, Narragansett, RI
Kennedy, V.S.	Univ. Maryland, Horn Point Environmental Lab., Cambridge, MD
Klein-MacPhee, G.	Univ. Rhode Island, Graduate School of Oceanography, Narragansett, RI
Kraeuter, J.N.	Rutgers Univ., Shellfish Research Lab., Port Norris, NJ
Lipcius, R.N.	Virginia Institute of Marine Science, Gloucester Pt., VA
Lippson, R.L.	NOAA/NMFS Oxford Lab., Oxford, MD
Loesch, J.G.	Virginia Institute of Marine Science, Gloucester Pt., VA
Lowerre, S.	Virginia Institute of Marine Science, Gloucester Pt., VA
Lucy, J.A.	Virginia Institute of Marine Science, Gloucester Pt., VA
Luo, J.	Univ. Maryland, Chesapeake Biological Lab., Solomons, MD
Lupine, A.	New Jersey Div. Fish, Game, and Wildlife, Lebanon, NJ
Lynch, M.P.	Virginia Institute of Marine Science, Gloucester Pt., VA
Lynch, T.R.	Rhode Island Div. Fish and Wildlife, Wakefield, RI
MacHaffie, E.	NOAA/NMFS Sandy Hook Lab., Highlands, NJ
MacKenzie, C.L., Jr.	NOAA/NMFS Sandy Hook Lab., Highlands, NJ
Maiden, A.	Environmental Consulting Services, Inc., Middletown, DE
McKown, K.A.	New York St. Dept. Environmental Conservation, Stony Brook, NY
Merriner, J.V.	NOAA/NMFS Beaufort Lab., Beaufort, NC

Michels, S.F.	Delaware Div. Fish and Wildlife, Little Creek, DE
Mihursky, J.A.	Chesapeake Research Consortium, Solomons, MD
Miller, J.	U.S. Fish and Wildlife Service, West Trenton, NJ
Miller, R.W.	Delaware Div. Fish and Wildlife, Dover, DE
Monteleone, D.M.	St. Univ. New York, Marine Sciences Research Center, Stony Brook, NY
Mountford, K.	U.S. EPA Chesapeake Bay Program, Annapolis, MD
Musick, J.A.	Virginia Institute of Marine Science, Gloucester Pt., VA
Newell, R.I.E.	Univ. Maryland, Horn Point Environmental Lab., Cambridge, MD
O'Dell, J.	Maryland Dept. Natural Resources, Annapolis, MD
O'Herron, J.C., Jr.	Mount Holly, NJ
Olney, J.E.	Virginia Institute of Marine Science, Gloucester Pt., VA
Pacheco, A.L.	NOAA/NMFS Sandy Hook Lab., Highlands, NJ
Price, K.S.	Univ. Delaware, College of Marine Studies, Lewes, DE
Rice, M.A.	Univ. Rhode Island, Dept. Fisheries and Veterinary Science, Kingston, RI
Savoy, T.F.	Connecticut Dept. Environmental Protection, Marine Fisheries, Waterford, CT
Scherer, M.D.	Marine Research Inc., Falmouth, MA
Schwartz, F.J.	Univ. North Carolina, Institute of Marine Science, Morehead City, NC
Scott, R.F.	Maryland Dept. Natural Resources, Annapolis, MD
Seagraves, R.J.	Mid-Atlantic Fishery Management Council, Dover, DE
Seaver, D.	Virginia Institute of Marine Science, Gloucester Pt., VA
Shirey, C.A.	Delaware Div. Fish and Wildlife, Smyrna, DE
Sminkey, T.	Virginia Institute of Marine Science, Gloucester Pt., VA
Stagg, C.M.	Coastal Environmental Services, Linthicum, MD
Steimle, F.W.	NOAA/NMFS Sandy Hook Lab., Highlands, NJ
Tabbit, C.	Virginia Institute of Marine Science, Gloucester Pt., VA
Taylor, M.H.	Univ. Delaware, School of Life and Health Sciences, Newark, DE
Tinsman, J.C.	Delaware Div. Fish and Wildlife, Little Creek, DE
Uphoff, J.H.	Maryland Dept. Natural Resources, Annapolis, MD

Van Heukelem, W.F.	Univ. Maryland, Horn Point Environmental Lab., Cambridge, MD
Vecchio, V.J.	New York St. Dept. Environmental Conservation, Stony Brook, NY
Volk, J.	Connecticut Dept. Agriculture, Aquaculture Div., Milford, CT
Vouglitois, J.J.	General Public Utilities Nuclear Corp., Forked River, NJ
Weber, A.	New York St. Dept. Environmental Conservation, Stony Brook, NY
Weisberg, S.B.	Versar, Inc., Columbia, MD
Whitworth, W.R.	Univ. Connecticut, Dept. Natural Resources and Engineering, Storrs, CT
Wiley, M.L.	Univ. Maryland, Chesapeake Biological Lab., Solomons, MD
Williams, A.B.	NOAA/NMFS Systematics Lab., Washington, DC
Williams, C.D.	Virginia Institute of Marine Science, Gloucester Pt., VA
Young, B.H.	New York St. Dept. Environmental Conservation, Stony Brook, NY

Appendix 4. References

1. Abbe, G.R. 1985. Changes in population structure from 1979 to 1983 related to increased spat setting on an oyster bar in central Chesapeake Bay. J. Shellfish Res. 5(1): 31.

2. Abbe, G.R. 1988. Population structure of the American oyster, *Crassostrea virginica*, on an oyster bar in central Chesapeake Bay: Changes associated with shell planting and increased recruitment. J. Shellfish Res. 7(1): 33-40.

3. Able, K.W. 1992. Checklist of New Jersey saltwater fishes. Bull. N.J. Acad. Sci. 37(1): 1-11.

4. Able, K.W., R.E. Matheson, W.W. Morse, M.P. Fahay, and G. Shepard. 1989. Patterns of summer flounder *Paralichthys dentatus* early life history in the Mid-Atlantic Bight and New Jersey estuaries. Fish. Bull., U.S. 88: 1-12.

5. Able, K.W., and R.E. Palmer. 1988. Salinity effects on fertilization success and larval mortality of *Fundulus heteroclitus*. Copeia 2: 345-350.

6. Able, K.W., C.W. Talbot, and J.K. Shisler. 1983. The spotfin killifish, *Fundulus luciae*, is common in New Jersey salt marshes. Bull. N.J. Acad. Sci. 28(1): 7-11.

7. Abraham, B.J. 1985. Species profiles: life histories and environmental requirements of coastal fishes and invertebrates (Mid-Atlantic) - mummichog and striped killifish. U.S. Fish Wildl. Serv. Biol. Rep. 82(11.40). U.S. Army Corps of Engineers, TR EL-82-4. 23 p.

8. Abraham, B.J., and P.L. Dillon. 1986. Species profiles: life histories and environmental requirements of coastal fishes and invertebrates (Mid-Atlantic) - softshell clam. U.S. Fish Wildl. Serv. Biol. Rep. 82(11.68). U.S. Army Corps of Engineers, TR EL-82-4. 18 p.

9. Allen, D.M., J.P. Clymer, and S.S. Herman. 1978. Fishes of the Hereford Inlet estuary, southern New Jersey. Dept. Biology and Ctr. for Marine and Environmental Studies, Lehigh Univ., Bethlehem, PA., and The Wetlands Institute. 62 p.

10. Andersen, B.D., and S.M. Jinks. 1988. Preoperational Aquatic Ecology Study, Shoreham Nuclear Power Station, Unit 1, 1983-1986. EA Rep. 10344.01. EA Science and Technology, Middletown, NY.

11. Andersen, B.D., and S.M. Jinks. 1989. Preoperational Aquatic Ecology Study, Shoreham Nuclear Power Station, Unit 1, 1987. EA Rep. 10344.01. EA Science and Technology, Newburgh, NY.

12. Andersen, B.D., and S.M. Jinks. 1989. Preoperational Aquatic Ecology Study, Shoreham Nuclear Power Station, Unit 1, 1988. EA Rep. 10344.01. EA Science and Technology, Newburgh, NY.

13. Andersen, B.D., and S.M. Jinks. 1990. Preoperational Aquatic Ecology Study Shoreham Nuclear Power Station, Unit 1, 1989. EA Rep. 60034.01. EA Engineering, Science, and Technology, Newburgh, NY.

14. Anderson, G. 1985. Species profiles: life histories and environmental requirements of coastal fishes and invertebrates (Gulf of Mexico) - grass shrimp. U.S. Fish Wildl. Serv. Biol. Rep. 82(11.35). U.S. Army Corps of Engineers, TR EL-82-4. 19 p.

15. Andrews, J.D. 1983. Transport of bivalve larvae in James River, Virginia. Estuaries 8(2B): 70A.

16. Applegate, A.J. 1983. An environmental model predicting the relative recruitment success of the blue crab, *Callinectes sapidus* (Rathbun) in Chesapeake Bay, Virginia. M.A. thesis, Virginia Inst. Marine Science, Coll. William and Mary, Gloucester Pt., VA. 73 p.

17. Arve, J. 1960. Preliminary report on attracting fish by oyster shell plantings in Chincoteague Bay, Maryland. Chesapeake Sci. 1(1):58-65.

18. Atran, S.M. 1986. Fluctuations in the catchability coefficient of Atlantic menhaden, 1968-1982. M.A. thesis, Virginia Inst. Marine Science, Coll. William and Mary, Gloucester Pt., VA. 84 p.

19. Auster, P.J. 1989. Species profiles: life histories and environmental requirements of coastal fishes and invertebrates (North and Mid-Atlantic) - tautog and cunner. U.S. Fish Wildl. Serv. Biol. Rep. 82(11.105). U.S. Army Corps of Engineers, TR EL-82-4. 22 p.

20. Auster, P.J., and L.L. Stewart. 1986. Species profiles: life histories and environmental requirements of coastal fishes and invertebrates (North Atlantic) - sand lance. U.S. Fish Wildl. Serv. Biol. Rep. 82(11.66). U.S. Army Corps of Engineers, TR EL-82-4. 20 p.

21. Austin, H., D.S. Haven, and M.S. Moustafa. 1993. The relationship between trends in a condition index of the American oyster, *Crassostrea virginica*, and environmental parameters in three Virginia estuaries. Estuaries 16(2): 362-374.

22. Austin, H.M. 1981. Assessment and monitoring of sciaenid stocks, with particular reference to the weakfish, *Cynoscion regalis*. Va. Mar. Resour. Rep. 81-10.

23. Ayvazian, S.G., L.A. Deegan, and J.T. Finn. 1992. Comparison of habitat use by estuarine fish assemblages in the Acadian and Virginian zoogeographic provinces. Estuaries 15: 368-383.

24. Badger, C.J. 1979. Saltmarsh ecology, Part II. Fish of the saltmarsh. Va. Wildl. 40(1): 24-25.

25. Barans, C.A. 1969. Distribution, growth, and behavior of the spotted hake in the Chesapeake Bight. M.A. thesis, Virginia Inst. Marine Science, Coll. William and Mary, Gloucester Pt., VA. 54 p.

26. Barans, C.A. 1972. Spotted hake, *Urophcis regius*, of the York River and Lower Chesapeake Bay. Chesapeake Sci. 13(1): 59-68.

27. Barila, T.Y., and J.R. Stauffer. 1980. Temperature behavioral responses of the American eel, *Anguilla rostrata*, from Maryland. Hydrobiologia 74(1): 49-51.

28. Bath, D.W., and J.M. O'Conner. 1985. Food preferences of white perch in the Hudson River estuary. N.Y. Fish Game J. 32: 63-70.

29. Bayliff, W.H., Jr. 1950. The life history of the silverside *Menidia menidia* (Linnaeus). Maryland Bd. Natural Resources, Dept. Resources and Education, Pub. No. 90.

30. Beal, K.L. 1968. Age and growth of the blueback herring *Alosa aestivalis* . M.A. thesis, Virginia Inst. Marine Science, Coll. William and Mary, Gloucester Pt., VA. 83 p.

31. Beaven, G.F. 1954. Various aspects of oyster setting in Maryland. Proc. Natl. Shellfisheries Assoc. 45: 29-37.

32. Berg, D.L., and J.S. Levinton. 1985. The Biology of the Hudson-Raritan Estuary, with Emphasis on Fishes. NOAA Tech. Memo. NOS OMA 16. NOAA/NOS, Rockville, MD. 170 p.

33. Bieder, R.C. 1971. Age and growth in the American eel, *Anguilla rostrata*, in Rhode Island. M.S. thesis, Univ. Rhode Island, Kingston, RI. 41 p.

34. Bigelow, H.B., and W.C. Schroeder. 1953. Fishes of the Gulf of Maine. U.S. Fish Wildl. Serv., Fish. Bull. No. 53. 577 p.

35. Bigelow, H.B., and W.C. Schroeder. 1953. Fishes of the Western North Atlantic. Memoir No. 1, Part 2. Sawfishes, guitarfishes, skates, rays, and chimaeroids. Sears Found. Mar. Res., Yale Univ., New Haven, CT. 588 p.

36. Bigelow, H.B., and W.C. Schroeder. 1963. Fishes of the Western North Atlantic. Memoir No. 1, Part 3. Soft-rayed bony fishes. Sears Found. Mar. Res., Yale Univ., New Haven, CT. 630 p.

37. Bireley, L.E. 1984. Multivariate analysis of species composition of shore-zone fish assemblages found in Long Island Sound. Estuaries 7: 242-247.

38. Blake, M.M. 1988. Connecticut Lobster Investigations. Connecticut Dept. Environmental Protection. Completion Report, Project No. 3-374-R. 103 p.

39. Blaylock, R.A. 1989. A massive school of cownose rays, *Rhinoptera bonasus* (Rhinopteridae), in Lower Chesapeake Bay, Virginia. Copeia 1989(3): 744-748.

40. Blaylock, R.A. 1993. Distribution and abundance of the cownose ray, *Rhinoptera bonansus*, in lower Chesapeake Bay. Estuaries 16(2): 255-263.

41. Bleil, D.F. 1978. Ekman transport is a factor contributing to population variations of the Atlantic croaker, *Micropogon undulatus* (Linnaeus), in Chesapeake Bay. M.S. thesis, American Univ., Washington, DC.

42. Blumberg, L., and J.G. Loesch. 1988. Study of *Alosa* stock composition and year-class strength in Virginia. Annual Report, Anadromous Fish Project 1987, Project No. AFC 20-1. Virginia Inst. Marine Science, Coll. William and Mary, Gloucester Pt., VA.

43. Blumberg, L., and J.G. Loesch. 1989. Study of *Alosa* stock composition and year-class strength in Virginia. Annual Report, Anadromous Fish Project 1988, Project No. AFC 20-2. Virginia Inst. Marine Science, College of William and Mary, Gloucester Pt., VA.

44. Boreman, J. and H.M. Austin. 1985. Production and harvest of anadromous striped bass stocks along the Atlantic Coast. Trans. Am. Fish. Soc. 114: 3-7.

45. Boreman, J., and R.R. Lewis. 1987. Atlantic coastal migration of striped bass. *In* Dadswell, M.J., R.J. Klauda, C.M. Moffitt, R.L. Saunders, R.A. Rulifson, and J.E. Cooper (eds.), pp. 331-339. Common Strategies of Anadromous and Catadromous Fishes. American Fisheries Society Symposium 1. American Fisheries Society, Bethesda, MD. 561 p.

46. Bourne, D.W., and J.J. Govoni. 1988. Distribution of fish eggs and larvae and patterns of water circulation in Narragansett Bay, 1972-1973. *In* Weinstein, M.P. (ed.), pp. 132-148. Larval Fish and Shellfish Transport Through Inlets. American Fisheries Society Symposium 3. American Fisheries Society, Bethesda, MD. 165 p.

47. Bowen, B.W. 1988. Population structure of the white perch, *Morone americana*, in lower Chesapeake Bay as inferred from mitochondrial DNA restriction analysis. M.A. thesis, Virginia Inst. Marine Science, Coll. William and Mary, Gloucester Pt., VA.

48. Bowler, M.W., and A.J. Seidenberg. 1971. Salinity tolerance of the prawns *Palaemonetes vulgaris* and *Palaemonetes pugio* and its relationship to the distribution of these species in nature. Va. J. Sci. 22(3): 94.

49. Bozeman, E.L., and M.J. Van Den Avyle. 1989. Species profiles: life histories and environmental requirements of coastal fishes and invertebrates (Mid-Atlantic) - summer and winter flounder. U.S. Fish Wildl. Serv. Biol. Rep. 82(11.112). U.S. Army Corps of Engineers, TR EL-82-4. 17 p.

50. Breitburg, D.L. 1989. Demersal schooling prior to settlement by larvae of the naked goby. Environ. Biol. Fishes 26(2): 97-103.

51. Briggs, P.T. 1968. Comparison of the fish fauna over sand-filled and natural bottoms of Great South Bay, New York - A progress report. *In* Pacheco, A.L. (ed.), pp. 220-246. Proceedings of a workshop on egg, larval, and juvenile stages of fish in Atlantic coast estuaries. Atlantic States Marine Fisheries Commission and U.S. Fish and Wildlife Service. Bears Bluff Laboratories, Wadmalaw Island, SC, June 1968.

52. Briggs, P.T. 1975. An evaluation of artifical reefs in New York's marine waters. N.Y. Fish Game J. 22: 51-56.

53. Briggs, P.T. 1975. Shore-zone fishes of the vicinity of Fire Island Inlet, Great South Bay, New York. N.Y. Fish Game J. 22: 1-12.

54. Briggs, P.T. 1985. Movements of American lobsters tagged off the south shore of Long Island, New York. N.Y. Fish Game J. 32: 21-25.

55. Briggs, P.T. 1985. The daytime recreational fishery for crabs from banks and piers in Great South Bay, New York. N.Y. Fish Game J. 32(1): 53-62.

56. Briggs, P.T., and W.M. McGroarty. 1985. Departures from the normal molting and reproductive cycle of female lobsters from Long Island Sound, New York. N.Y. Fish Game J. 32: 211-212.

57. Briggs, P.T., and F.M. Mushacke. 1979. The American lobster in western Long Island Sound. N.Y. Fish Game J. 26: 59-86.

58. Briggs, P.T., and F.M. Mushacke. 1984. The American lobster in western Long Island Sound: movement, growth and mortality. N.Y. Fish Game J. 31: 21-37.

59. Briggs, P.T., and J.S. O'Connor. 1971. Comparison of shore-zone fishes over naturally vegetated and sand-filled bottoms in Great South Bay. N.Y. Fish Game J. 18: 15-41.

60. Briggs, P.T., and C.S. Zawacki. 1974. American lobsters at artificial reefs in New York. N.Y. Fish Game J. 21(4): 73-77.

61. Brousseau, D.J. 1987. A comparative study of the reproductive cycle of the soft-shell clam, *Mya arenaria* in Long Island Sound. J. Shellfish Res. 6: 7-15.

62. Brousseau, D.J., and J.A. Baglivo. 1987. A comparative study of age and growth in *Mya arenaria* (soft-shell clam) from three populations in Long Island Sound. J. Shellfish Res. 6: 17-24.

63. Brousseau, D.J., and J.A. Baglivo. 1988. Life tables for two field populations of soft-shell clam, *Mya arenaria*, (mollusc: pelecypoda) from Long Island Sound. Fish. Bull., U.S. 86: 567-579.

64. Brown, N.J. 1981. Reproductive biology and recreational fishery for spotted seatrout, *Cynoscion nebulosus*, in the Chesapeake Bay area. M.A. thesis, Virginia Inst. Marine Science, Coll. William and Mary, Gloucester Pt., VA. 120 p.

65. Brundage, H.M., III. 1981. Notes on Atlantic and shortnose sturgeon. Underwater Nat. 13(2): 13-16.

66. Brundage, H.M., and R.E. Meadows. 1981. The Atlantic sturgeon, *Acipenser oxyrhynchus*, in the Delaware River estuary. Fish. Bull., U.S. 80: 337-343.

67. Brundage, H.M., and R.E. Meadows. 1982. Occurrence of the endangered shortnose sturgeon, *Acipenser brevirostrum*, in the Delaware River estuary. Estuaries 5(3): 203-208.

68. Buckley, J., and B. Kynard. 1985. Habitat use and behavior of pre-spawning and spawning shortnose sturgeon, *Acipenser brevirostrum*, in the Connecticut River. *In* Binkowski, F.P., and S.I. Doroshov (eds.). North American Sturgeons: Biology and Aquaculture Potential. Environ. Biol. Fishes 6: 111-118.

69. Buckley, J., and B. Kynard. 1985. Yearly movements of shortnose sturgeons in the Connecticut River. Trans. Am. Fish. Soc. 114(6): 813-820.

70. Buckley, J.L. 1989. Species profiles: life histories and environmental requirements of coastal fishes and invertebrates (North Atlantic) - rainbow smelt. U.S. Fish Wildl. Serv. Biol. Rep. 82(11.106). U.S. Army Corps of Engineers, TR EL-82-4.

71. Buckley, J.L. 1989. Species profiles: life histories and environmental requirements of coastal fishes and invertebrates (North Atlantic) - winter flounder. U.S. Fish Wildl. Serv. Biol. Rep. 82(11.87). U.S. Army Corps of Engineers, TR EL-82-4. 12 p.

72. Buckley, L.J., and E.M. Caldarone. 1988. Recent growth and biochemical composition of juvenile young-of-year winter flounder from different areas of Narrangansett Bay. U.S. Environmental Protection Agency, Narragansett Bay Program. 40 p.

73. Buckley, L.J., T.A. Halavik, G.C. Laurence, S.J. Hamilton, and P. Yevich. 1985. Comparative swimming stamina, biochemical composition, backbone mechanical properties, and histopathology of juvenile striped bass from rivers and hatcheries of the eastern United States. Trans. Am. Fish. Soc. 114: 114-124.

74. Burbidge, R.G. 1972. Distribution, growth, selective feeding, and energy transformations of young-of-the-year blueback herring, *Alosa aestivalis*, in the James River, Virginia. Ph.D. dissertation, Univ. Virginia, Charlottesville, VA. 131 p.

75. Burbidge, R.G. 1974. Distribution, growth, selective feeding, and energy transformations of young-of-the-year blueback herring, *Alosa aestivalis* , in the James River, Virginia. Trans. Am. Fish. Soc. 103(2): 297-311.

76. Burrell, V.G., Jr. 1986. Species profiles: life histories and environmental requirements of coastal fishes and invertebrates (South Atlantic) - American oyster. U.S. Fish Wildl. Serv. Biol. Rep. 82(11.57). U.S. Army Corps of Engineers, TR EL-82-4. 17 p.

77. Burton, W.H. 1982. Comparative ecology of two sympatric species of atherinids, *Menidia menidia* and *Membras martinica*. M.A. thesis, Virginia Inst. Marine Science, Coll. William and Mary, Gloucester Pt., VA. 84 p.

78. Butt, A.J., and R.W. Alden III. 1985. Characterization of mero- and ichthyoplankton communities within the Chesapeake Bay plume off Virginia Beach, Virginia during 1983-1984. Appl. Mar. Res. Lab., Old Dominion Univ., Norfolk, VA. 219 p.

79. Butt, A.J., R.W. Alden III, and R.J. Young, Jr. 1985. Important meroplankton of the Lower Chesapeake Bay and proposed Norfolk disposal site. II. Crustaceans and ichthyoplankton. Applied Mar. Res. Lab., Old Dominion Univ., Norfolk, VA. 223 p.

80. Buzzards Bay Project. 1990. The Buzzards Bay lobster resource and fishery. Draft manuscript. 20 p.

81. Buzzards Bay Project. 1990. The Buzzards Bay shellfish resource and fishery. Draft manuscript. 21 p.

82. Buzzards Bay Project. 1990. The finfish of Buzzards Bay. Draft manuscript. 27 p.

83. Byrne, D. 1986. Anadromous herring run restoration (Annual report No. AFC-8-1). New Jersey Department of Environmental Protection, Division of Fish, Game, and Wildlife.

84. Byrne, D.M. 1976. Life history of the spotfin killifish, *Fundulus luciae* (Pisces: Cyprinodontidae), in Fox Creek Marsh, Virginia. M.A. thesis, Virginia Inst. Marine Science, Coll. William and Mary, Gloucester Pt., VA. 56 p.

85. Byrne, D.M. 1991. Beach seine survey for New Jersey Portion of Raritan Bay, 1982-1983. Unpublished data. N.J. Dept. Environmental Protection, Port Republic, NJ.

86. Campbell, A., and D.S. Pezzack. 1986. Relative egg production and abundance of berried lobsters, *Homarus americanus*, in the Bay of Fundy and off southwestern Nova Scotia. Can. J. Fish. Aquat. Sci. 43(11): 2190-2196.

87. Campbell, T.G. 1975. The fishes and hydrographic paramenters of White Creek, Delaware. M.S. thesis, Univ. Delaware, Newark, DE.

88. Cargo, D.C. 1958. The migration of adult female crabs, *Callinectes sapidus* Rathbun, in Chincoteague Bay and adjacent waters. J. Mar. Res. 16:180-191.

89. Carter, W.R., III. 1972. Ecological study of the Susquehanna River and tributaries below the Conowingo Dam. Completion Report, Proj. No. AFSC-1. Maryland Dept. Natural Resources, Annapolis, MD.

90. Casey, J.F., S.P. Minkkinen, and J.B. Soldo. 1988. Characterization of Choptank River populations of white, *Morone americana*, and yellow, *Perca flavescens*, perch. Final Report, FY 1986. Maryland Dept. Natural Resources, Annapolis, MD. 102 p.

91. Casey, J.F., R.C. Raynie, and A.E. Wesche. 1992. Investigation of Maryland's Atlantic Ocean and coastal bay finfish stocks - 1991 surveys. Federal Aid Project No. F-50-R-1. Maryland Dept. Natural Resources, Tidewater Admin., Annapolis, MD. 42 p.

92. Chao, L.N. 1976. Aspects of systematics, morphology, life history and feeding of western Atlantic Sciaenidae. Ph.D. dissertation, Virginia Inst. Marine Science, Coll. William and Mary, Gloucester Pt., VA. 342 p.

93. Chenoweth, S. 1963. Spawning and fecundity of the tautog, *Tautoga onitis*. M.S. thesis, Univ. Rhode Island., Kingston, RI. 60 p.

94. Chittenden, M.E., Jr. 1971. Status of the striped bass, *Morone saxatilis*, in the Delaware River. Chesapeake Sci.12(3): 131-136.

95. Chittenden, M.E., Jr. 1974. Trends in the abundance of the American shad, *Alosa sapidissima*, in the Delaware River Basin. Chesapeake Sci. 15(2): 96-103.

96. Chittenden, M.E., Jr. 1976. Present and historical spawning grounds and nurseries of American shad, *Alosa sapidissima*, in the Delaware River. Fish. Bull., U.S. 74(2): 343-352.

97. Chowning, L.S. 1988. Harvesting Chesapeake eels for the European market. National Fisherman 69(6): 29-30.

98. Chowning, L.S. 1989. Stake nets are still effective on Chesapeake Bay shad. National Fisherman (August 1989): 58-60.

99. Clayton, G.R., C.F. Cole, S.A. Murawski, and J.D. Parrish. 1978. Common marine fishes of coastal Massachusetts: a literature review. Univ. Mass. Inst. Environ. Publ. R-76-16: 1-274.

100. Cobb, J.S., T. Gulbransen, B.F. Phillips, D. Wang, and M. Syslo. 1983. Behavior and distribution of larval and early juvenile *Homarus americanus*. Can. J. Fish. Aquat. Sci. 40(12): 2184-2188.

101. Cobb, J.S., D. Wang, D.B. Campbell, and P. Rooney. 1989. Speed and direction of swimming by poslarvae of the American lobster. Trans. Am. Fish. Soc. 118(1): 82-86.

102. Cohen, M., and G.S. Fishman. 1983. Modelling estuarine migration and abundance of the brown shrimp (*Penaeus aztecus*) of Pamlico sound, North Carolina. UNC Sea Grant College Publication No. UNC-SG-WP-83-1). Univ. North Carolina, Chapel Hill, NC.

103. Cole, C.F. 1969. The ecology of the young fishes of the Weweantic River Estuary. Project Completion Report, OWRR Project No. A-019 MASS. Univ. Mass., Water Resources Research Center, Amherst, MA. 15 p.

104. Cole, R.W., R.A. Beck, and L.J. Spence. 1977. Technical assistance to commercial fisheries, Delaware Project 3-216-D-2, Final Report. NOAA/NMFS Div. Federal Aid. 200 p.

105. Cole, R.W., and J.C. Tinsman. 1980. Technical assistance to commercial fisheries, Delaware Project 3-280-D-3, Annual Performance Report. NOAA/NMFS Div. Federal Aid. 96 p.

106. Collings, W.S., C. Cooper-Sheehan, S.C. Hughes, and J.L. Buckley. 1981. The effects of power generation on some of the living marine resources of of the Cape Cod Canal and approaches. Mass. Div. Marine Fisheries. 212 p.

107. Collins, M.R. 1985. Species profiles: life histories and environmental requirements of coastal fishes and invertebrates (South Florida) - striped mullet. U.S. Fish Wildl. Serv. Biol. Rep. 82(11.34). U.S. Army Corps of Engineers, TR EL-82-4. 11 p.

108. Collins, M.R. 1985. Species profiles: life histories and environmental requirements of coastal fishes and invertebrates (South Florida) - white mullet. U.S. Fish Wildl. Serv. Biol. Rep. 82(11.39). U.S. Army Corps of Engineers, TR EL-82-4. 7 p.

109. Colton, J.B., W.G. Smith, A.W. Kendall, Jr., P.L. Berrien, and M.P. Fahay. 1979. Principal spawning areas and times of marine fishes, Cape Sable to Cape Hatteras. Fish. Bull., U.S. 76: 911-915.

110. Comyns, B.H. 1987. Identification and distribution of *Urophycis* (Gill) and *Phycis* (Artedi) larvae and pelagic juveniles in the Middle Atlantic Bight. M.S. thesis, Virginia Inst. Marine Science, Coll. William and Mary, Gloucester Pt., VA. 130 p.

111. Conover, D., R. Cerrato, and H. Bokuniewicz. 1985. Effect of Borrow Pits on the Abundance and Distribution of Fishes in the Lower Bay of the New York Harbor. Spec. Rep. 64, Ref. 85-20. State Univ. New York, Marine Sciences Research Center, Stony Brook, NY. 68 p.

112. Conover, D.O., and S.A. Murawski. 1982. Offshore winter migration of the Atlantic silverside, *Menidia menidia*. Fish. Bull., U.S. 80: 145-150.

113. Cook, A.C. 1974. An experimental study of habitat selection by juveniles of six species of Sciaenids found in the lower York River, Virginia. M.A. thesis, Virginia Inst. Marine Science, Coll. William and Mary, Gloucester Pt., VA. 59 p.

114. Cooper, R.A. 1961. Early life history and spawning migration of the alewife, *Alosa pseudoharengus*. M.S. thesis, Univ. Rhode Island, Kingston, RI. 58 p.

115. Cooper, R.A. 1966. Migration and population estimation of the tautog, *Tautoga onitis*, from Rhode Island. Trans. Am. Fish. Soc. 95: 239-247.

116. Cooper, R.A. and J.R. Uzmann. 1980. Ecology of juvenile and adult *Homarus*. *In* Cobb, J.S., and B.F. Phillips (eds.), pp 97-142. The Biology and Management of Lobsters: Physiology and Behavior. Academic Press, New York.

117. Corey, S. 1981. The life history of *Crangon septemspinosa* (decapoda, caridea) in the shallow sublittoral area of Passamaquoddy Bay, New Brunswick, Canada. Crustaceana 41: 21-25.

118. Corey, S. 1987. Reproductive strategies and comparative fecundity of *Crangon septimspinosa* (Decapoda, Caridea). Crustaceana 52(1): 25-28.

119. Coutant, C.C., and D.L. Benson. 1990. Summer habitat suitability for striped bass in Chesapeake Bay: reflections on a population decline. Trans. Am. Fish Soc. 119(4): 757-778.

120. Cowan, J.H. 1981. The seasonality of occurrence of larval and juvenile sciaenids in a Virginia seaside estuary. M.S. thesis, Old Dominion Univ., Norfolk, VA.

121. Cowan, J.H., Jr., and R.S. Birdsong. 1985. Seasonal occurrence of larval and juvenile fishes in a Virginia Atlantic Coast estuary with emphasis on drums (Family Scianidae). Estuaries 8(1): 48-59.

122. Cowan, J.H., Jr., R.S. Birdsong, E.D. Houde, J.S. Priest, W.C. Sharp, and G.B. Mateja. 1992. Enclosure experiments on survival and growth of black drum eggs and larvae in lower Chesapeake Bay. Estuaries 15(3): 392-402.

123. Cowles, R.P. 1930. A biological study of the offshore water of Chesapeake Bay. Bull. U.S. Bur. Fish. 46: 277-381.

124. Cox, C. 1988. Seasonal changes in fecundity of oysters *Crassostrea virginica* (Gmelin) from four oyster reefs in the James River, Virginia. M.A. thesis, Virginia Inst. Marine Science, Coll. William and Mary, Gloucester Pt., VA.

125. Crecco, V., T. Savoy, and L. Gunn. 1983. Daily mortality rates of larval and juvenile American shad (*Alosa sapidissma*) in the Connecticut River with changes in year-class strength. Can. J. Fish. Aquat. Sci. 40: 1719-1728.

126. Crecco, V.A., and T.F. Savoy. 1985. Effects of biotic and abiotic factors on growth and relative survival of young American shad, *Alosa sapidissima*, in the Connecticut River. Can. J. Fish. Aquat. Sci. 42: 1640-1648.

127. Crestin, D.S. 1973. Some aspects of the biology of adults and early life stages of rainbow smelt, *Osmerus mordax*, from the Weweantic River estuary, Wareham-Marion, Massachusetts, 1968. M.S. thesis, Univ. Massachusetts, Amherst, MA. 108 p.

128. Crumb, S.E. 1977. Macrobenthos of the tidal Delaware River between Trenton and Burlington, New Jersey. Chesapeake Sci. 18(3): 253-265.

129. Curley, J.R., R.P. Lawton, D.L. Chadwick, K. Reback, and J.M. Hickey. 1974. A study of the marine resources of the Taunton River and Mount Hope Bay, Massachusetts. Mass. Div. Marine Fisheries, Wareham, MA. 37 p.

130. Curley, J.R., R.P. Lawton, J.M. Hickey, and J.D. Fiske. 1971. A study of the marine resources of the Waquoit Bay-Eel Pond estuary. Monogr. Ser. No. 9. Mass. Div. Marine Fisheries. 40 p.

131. Dadswell, M.J., G.D. Melvin, P.J. Williams, and D.E. Themelis. 1987. Influences of origin, life history, and chance on the Atlantic Coast migration of American shad. *In* Dadswell, M.J., R.J. Klauda, C.M. Moffitt, R.L. Saunders, R.A. Rulifson, and J.E. Cooper (eds.), pp. 313-330. Common Strategies of Anadromous and Catadromous Fishes. American Fisheries Society Symposium 1. American Fisheries Society, Bethesda, MD. 561 p.

132. Dadswell, M.J., B.D. Taubert, T.S. Squiers, D. Marchette, and J. Buckley. 1984. Synopsis of biological data on shortnose sturgeon, *Acipenser brevirostrum*. NOAA Tech. Rep. NMFS-14.

133. Daiber, F.C., and R. Smith. 1972. An Analysis of Fish Populations in the Delaware Bay Area. 1971-1972 Annual Dingell-Johnson Report to Delaware Div. Fish and Wildlife, Project F-13-R-14. College of Marine Studies, Univ. Delaware, Lewes, DE. 93 p.

134. Daiber, F.C., L.L. Thornton, K.A. Bolster, T.G. Campbell, O.W. Crichton, G.L. Esposito, D.R. Jones, and J.M. Tyrawski. 1976. An atlas of Delaware's wetlands and estuarine resources. Univ. Delaware, College of Marine Studies. Delaware Coastal Management Program, Tech. Rep. No. 2.

135. Danie, D.S., J.G. Trial, and J.G. Stanley. 1984. Species profiles: life histories and environmental requirements of coastal fishes and invertebrates (North Atlantic) - Atlantic salmon. U.S. Fish Wildl. Serv. Biol. Rep. 82(11.22). U.S. Army Corps of Engineers, TR EL-82-4. 19 p.

136. Darcy, G.H. 1980. Comparison of ecological and life history information on Gobiid fishes, with emphasis on the south-eastern United States. NOAA Tech. Memo. NMFS-SEFC-15.

137. Dauer, D.M. 1984. Macrobenthic communities of the Lower Chesapeake Bay. Old Dominion Univ., Norfolk, VA. 417 p.

138. Dauer, D.M., R.M. Ewing, G.H. Toufellotte, W.T. Harlan, J.W. Sourbeer, and H.R. Barker. 1982. Predation resource limitation and the structure of benthic infaunal communities of the Lower Chesapeake Bay, USA. Int. Revue Ges. Hydrobiol. 67(4): 477-489.

139. Dauer, D.M., T.L. Stokes, H.R. Barker, R.M. Ewing, and J.W. Sourbeer. 1984. Macrobenthic communities of the lower Chesapeake Bay. IV. Bay-wide transects and the inner continental shelf. Int. Revue Ges. Hydrobiol. 69(1): 1-22.

140. de Sylva, D.P., F.A. Kalber, and C.N. Shuster. 1962. Fishes and ecological conditions in the shore zone of the Delaware River estuary, with notes on other species collected in deeper water. Technical report to the Delaware Board of Game and Fish Commissioners: Delaware Project F-13-R-1-2-3. 163 p.

141. Deegan, L.A., J.T. Finn, S.C. Murphy, and S.G. Ayvazian. 1991. Are critical habitats determined by life history strategies or habitat availability? Univ. Mass., Dept. Forestry and Wildlife Management. Final Tech. Rep. for NOAA/NOS Office of Ocean and Coastal Resource Management. 105 p.

142. Delany, G.R. 1987. Morphometric and meristic stock identification of summer flounder (*Paralichthys dentatus*). M.A. thesis, Virginia Inst. Marine Science, Coll. William and Mary, Gloucester Pt., VA.

143. Derickson, W.K., and K.S. Price, Jr. 1973. The fishes of the shore zone of Rehoboth and Indian River Bays, Delaware. Trans. Am. Fish. Soc. 102(3): 552-562.

144. Desfosse, J.C. 1987. Preliminary analysis of Virginia's black drum (*Pogonias cromis*) recreational and commercial fisheries. Va. Mar. Res. Rep. 87-7.

145. Desfosse, J.C. 1989. Meristic and morphometric comparison of three juvenile *Alosa* species; blueback herring, *A. aestivalis*; alewife, *A. pseudoharengus*; and American shad, *A. sapidissima*. M.A. thesis, Virginia Inst. Marine Science, Coll. William and Mary, Gloucester Pt., VA.

146. Dew, C.B. 1991. Early Life History and Population Dynamics of Atlantic Tomcod (*Microgadus tomcod*) in the Hudson River Estuary, New York. Ph.D. dissertation, City Univ. New York, New York, NY. 369 p.

147. DiNardo, G.T., K.T. Yetman, and J.K. Summers. 1984. Life history and exploitation synopses of northeastern fisheries, Vol. I - Anadromous fisheries. Draft manuscript. Martin Marietta Environmental Systems, Columbia, MD.

148. Dintaman, R.C. 1975. A preliminary study of the occurrence of the American eel and other finfish species in Maryland. Vol. I, 1974: Upper Chesapeake Bay drainage, Potomac River drainage. Maryland Dept. Natural Resources, Fisheries Admin., Anadromous Fish Stream Survey Program. 58 p.

149. Dintaman, R.C. 1976. A preliminary study of the occurrence of the American eel and other finfish species in Maryland. Vol. II, 1975: Chester River drainage. Maryland Dept. Natural Resources, Fisheries Admin., Anadromous Fish Stream Survey Program. 38 p.

150. Dittel, R., I. Anna, and C.E. Epifanio. 1982. Seasonal abundance and vertical distribution of crab larvae in Delaware Bay. Estuaries 5(3): 197-202.

151. Doubleday, W.G., and D. Rivard. 1981. Bottom trawl surveys: Proceedings of a workshop held at Ottawa, November 12-14, 1980. Canada Dept. Fisheries and Oceans, Scientific Information and Publications Branch, Ottawa, Ontario, Canada. 273 p.

152. Dovel, W. 1967. Fish eggs and larvae of the Magothy River, Maryland. Chesapeake Sci. 8(2): 125-129.

153. Dovel, W.L. 1971. Fish eggs and larvae of the upper Chesapeake Bay. Univ. of Md., Natural Resources Res. Inst., Solomons, MD. Spec. Rep. No. 4, Contrib. No. 460.

154. Dovel, W.L. 1981. Ichthyoplankton of the lower Hudson Estuary, New York. N.Y. Fish Game J. 28: 21-39.

155. Dovel, W.L., and A.J. Lippson. 1973. Spot, croaker, and weakfish. *In* Lippson, A.J. (ed.), p. 42-43. The Chesapeake Bay in Maryland: An Atlas of Natural Resources. Johns Hopkins Univ. Press, Baltimore, MD.

156. Drew, B.C. 1976. A contribution to the life history of the cunner, *Tautogolabrus adspersus*, in Fishers Island Sound, Connecticut. Chesapeake Sci. 17: 101-113.

157. Driscoll, E.G., and D.E. Brandon. 1973. Mollusc-sediment relationships in northwestern Buzzards Bay, Massachusetts, U.S.A. Malacologia 12: 13-46.

158. Durbin, A.G., and E.G. Durbin. 1988. Zooplankton and Ichthyoplankton in Narragansett Bay: Ichthyoplankton. New England Interstate Water Pollution Control Commission. 64 p.

159. Eaton, W.R., P.G. Piavis, B.H. Pyle, and E.J. Webb. 1990. Investigation of yellow perch (*Perca flavescens*) stocks in Maryland. Proj. No. F-46-R. Maryland Dept. Natural Resources, Annapolis, MD. 87 p.

160. Eaton, W.R., P.G. Piavis, and J.E. Van Tassel. 1989. Investigation of yellow perch (*Perca flavescens*) stocks in Maryland. Proj. No. F-46-R. Maryland Dept. Natural Resources, Annapolis, MD. 73 p.

161. Eaton, W.R., P.G. Piavis, B.H. Pyle, and E.J. Webb. 1991. Investigation of yellow perch (*Perca flavescens*) stocks in Maryland. Proj. No. F-46-R. Maryland Dept. Natural Resources, Annapolis, MD. 84 p.

162. Ecological Analysts. 1976. Ecological studies in the vicinity of Indian River power plant: A 316(a) demonstration, Vol. I. 150 p.

163. Eggleston, D.B. 1988. Predator-prey dynamics between the blue crab, *Callinectes sapidus*, and juvenile oysters *Crassostrea virginica*. M.A. thesis, Virginia Inst. Marine Science, Coll. William and Mary, Gloucester Pt., VA.

164. Eldridge, P.J. 1962. Observations on the winter trawl fishery for summer flounder, *Paralichthys dentatus*. M.A. thesis, Virginia Inst. Marine Science, Coll. William and Mary, Gloucester Pt., VA. 58 p.

165. Epifanio, C.E., C.C. Valenti, and A.E. Pembroke. 1984. Dispersal and recruitment of blue crab larvae in Delaware Bay, U.S.A. Estuarine Coastal Shelf Sci. 18: 1-12.

166. Estrella, B.T., and S.X. Cadrin. 1989. Massachusetts coastal commercial lobster trap sampling program, May-November, 1988. Mass. Div. Marine Fisheries, Pub. No. 16.024-26-75-7-89-C.R. 23 p.

167. Eversole, A.G. 1987. Species profiles: life histories and environmental requirements of coastal fishes and invertebrates (South Atlantic) - hard clam. U.S. Fish Wildl. Serv. Biol. Rep. 82(11.75). U.S. Army Corps of Engineers, TR EL-82-4.

168. Fabrizio, M.C. 1987. Growth-invariant discrimination and classification of striped bass stocks by morphometric and electrophoretic methods. Trans. Am. Fish. Soc. 116: 728-736.

169. Facey, D.E., and M.J. Van Den Avyle. 1986. Species profiles: life histories and environmental requirements of coastal fishes and invertebrates (South Atlantic) - American shad. U.S. Fish Wildl. Serv. Biol. Rep. 82(11.45). U.S. Army Corps of Engineers, TR EL-82-4.

170. Facey, D.E., and M.J. Van Den Avyle. 1987. Species profiles: life histories and environmental requirements of coastal fishes and invertebrates (North Atlantic) - American eel. U.S. Fish Wildl. Serv. Biol. Rep. 82(11.74). U.S. Army Corps of Engineers, TR EL-82-4. 28 p.

171. Fahay, M.P. 1978. Biological and fisheries data on American eel, *Anguilla rostrata*. NOAA Tech. Rep. NMFS-NEFC-17. 84 p.

172. Fairbanks, R.B., W.S. Collings, and W.T. Sides. 1971. An assessment of the effects of electrical power generation on marine resources in the Cape Cod Canal. Massachusetts Dept. Natural Resources, Div. Marine Fisheries. 48 p.

173. Fay, C.W., R.J. Neves, and G.B. Pardue. 1983. Species profiles: life histories and environmental requirements of coastal fishes and invertebrates (Mid-Atlantic) - alewife and blueback herring. U.S. Fish Wildl. Serv. Biol. Rep. 82(11.9). U.S. Army Corps of Engineers, TR EL-82-4. 25 p.

174. Fay, C.W., R.J. Neves, and G.B. Pardue. 1983. Species profiles: life histories and environmental requirements of coastal fishes and invertebrates (Mid-Atlantic) - Atlantic silverside. U.S. Fish Wildl. Serv. Biol. Rep. 82(11.10). U.S. Army Corps of Engineers, TR EL-82-4. 15 p.

175. Fay, C.W., R.J. Neves, and G.B. Pardue. 1983. Species profiles: life histories and environmental requirements of coastal fishes and invertebrates (Mid-Atlantic) - bay scallop. U.S. Fish Wildl. Serv. Biol. Rep. 82(11.12). U.S. Army Corps of Engineers, TR EL-82-4. 17 p.

176. Fay, C.W., R.J. Neves, and G.B. Pardue. 1983. Species profiles: life histories and environmental requirements of coastal fishes and invertebrates (Mid-Atlantic) - striped bass. U.S. Fish Wildl. Serv. Biol. Rep. 82(11.8). U.S. Army Corps of Engineers, TR EL-82-4. 36 p.

177. Fell, P.E., and A.M. Balsamo. 1985. Recruitment of *Mytilus edulis* in the Thames estuary, with evidence for differences in the time of maximal settling along the Connecticut shore. Estuaries 8: 68-75.

178. Ferraro, S.P. 1980. Pelagic fish eggs and larvae of the Peconic Bays, New York: 1972-1974. Ph.D. thesis, State Univ. New York, New York, NY.

179. Field, J.D. 1991. Estimating abundance and annual production of striped bass eggs with *in situ* silhouette photography. M.A. thesis, Virginia Inst. Marine Science, Coll. William and Mary, Gloucester Pt., VA.

180. Fletcher, R.I. 1990. Flow dynamics and fish recovery experiments: water intake systems. Trans. Am. Fish. Soc. 119: 393-415.

181. Fogarty, M.J. 1983. Distribution and relative abundance of American lobster, *Homarus americanus*, larvae: A review. NOAA Tech. Rep. NMFS Spec. Scient. Rep. Fish. No. 775, pp 3-8.

182. Fogarty, M.J., D.V. Borden, and H.J. Russell. 1980. Movements of tagged American lobster, *Homarus americanus*, off Rhode Island. Fish. Bull., U.S. 78: 771-780.

183. Forman, E.S. 1983. Scientific Research in the Providence River, Upper Narragansett Bay and Tributaries. Univ. Rhode Island, Graduate School of Oceanography, Narragansett, RI. 23 p.

184. Foster, N.R. 1974. Cyprinodontidae - Killifishes. *In* Lippson, A.J., and R.L. Moran (eds.), p. 127-141. Manual for identification of early developmental stages of fishes of the Potomac River estuary. Prepared for Power Plant Siting Program, Md. Dept. Natural Resources, by Martin Marietta Corp., Env. Tech. Ctr., Baltimore, MD. PPSP-MP-13.

185. Fox, R. 1988. Long Island Sound shellfish resource assessment 1987. Long Island Sound Study, Project Completion Report. New York Dept. Environmental Conservation, Stony Brook, NY.

186. Fox, R.E. 1981. An estimation of the recreational harvest of hard clams from Great South Bay, New York. N.Y. Fish Game J. 28: 81-87.

187. Friedland, K.D. 1984. Menhaden distribution as mediated by feeding. Ph.D. dissertation, Virginia Inst. Marine Science, Coll. William and Mary, Gloucester Pt., VA.

188. Friedland, K.D., G.C. Garman, A.J. Bejda, A.L. Studholme, and B. Olla. 1988. Interannual variation in diet and condition in juvenile bluefish during estuarine residency. Trans. Am. Fish. Soc. 117: 474-479.

189. Friedland, K.D., and L.W. Haas. 1988. Emigration of juvenile Atlantic menhaden, *Brevoortia tyrannus*, from the York River estuary. Estuaries 11(1): 45-50.

190. Frisbie, C.M. 1961. Young black drum, *Pogonias cromis*, in tidal fresh and brackish waters, especially in the Chesapeake and Delaware Bay areas. Chesapeake Sci. 2: 94-100.

191. Frithsen, J.B. 1988. The benthic communities within Narragansett Bay. Draft Manuscript. Univ. Rhode Island, Marine Ecosystem Research Lab, Narragansett, RI. 85 p.

192. Frithsen, J.B., K. Killam, and M. Young. 1991. An assessment of key biological resources in the Delaware River estuary. Versar, Inc., Columbia, MD.

193. Fritz, L.W. 1982. Annulus formation and microstructure of hard clam (*Mercenaria mercenaria*) shells. M.A. thesis, Virginia Inst. Marine Science, Coll. William and Mary, Gloucester Pt., VA. 161 p.

194. Fritz, L.W., and D.S. Haven. 1983. Annulus formation in the microstructure of the hard clam *Mercenaria mercenaria* in Virginia. J. Shellfish Res. 2(1): 95.

195. Fritzsche, R.A. 1978. Development of Fishes of the Mid-Atlantic Bight, An Atlas of Egg, Larval, and Juvenile Stages. Volume V, Chaetodontidae through Ophidiidae. U.S. Fish Wildl. Serv., Ofc. Biol. Serv. FWS/OBS-78/12. 340 p.

196. Funderburk, S.L., J.A. Mihursky, S.J. Jordan, and D. Riley. 1991. Habitat Requirements for Chesapeake Bay Living Resources, Second Edition. Chesapeake Research Consortium, Inc., Solomons, MD.

197. Gardinier, M.N., and T.B. Hoff. 1982. Diet of striped bass in the Hudson River estuary. N.Y. Fish Game J. 29: 152-163.

198. Geer, P.J., C.F. Bonzek, J.A. Colvocoresses, and R.E. Harris Jr. 1990. Juvenile finfish and blue crab stock assessment program bottom trawl survey annual report series. Spec. Sci. Rep. No. 124, Vol. 1989. Virginia Inst. Marine Science, Gloucester Pt., VA.

199. Geer, P.J., C.F. Bonzek, J.A. Colvocoresses, and R.E. Harris Jr. 1990. Juvenile finfish and blue crab stock assessment program bottom trawl survey annual report series. Spec. Sci. Rep. No. 124, Vol. 1990. Virginia Inst. Marine Science, Gloucester Pt., VA.

200. Gilbert, C.R. 1986. Species profiles: life histories and environmental requirements of coastal fishes and invertebrates (South Florida) - southern, gulf, and summer flounder. U.S. Fish Wildl. Serv. Biol. Rep. 82(11.54). U.S. Army Corps of Engineers, TR EL-82-4.

201. Gilbert, C.R. 1989. Species profiles: life histories and environmental requirements of coastal fishes and invertebrates (Mid-Atlantic) - Atlantic and shortnose sturgeon. U.S. Fish Wildl. Serv. Biol. Rep. 82(11.122). U.S. Army Corps of Engineers, TR EL-82-4.

202. Gleeson, R.A. 1977. Pheromone communication in the reproductive behavior of *Callinectes sapidus*. Ph.D. dissertation, Virginia Inst. Marine Science, Coll. William and Mary, Gloucester Pt., VA. 80 p.

203. Goodrich, D.M., J. Van Montfrans, and R.J. Orth. 1989. Blue crab megalopal influx to Chesapeake Bay: Evidence for a wind-driven mechanism. Estuarine Coastal Shelf Sci. 29(3): 247-260.

204. Goshorn, D.M., and C.E. Epifanio. 1991. Development, survival, and growth of larval weakfish at different prey abundances. Trans. Am. Fish. Soc. 120(6): 693-700.

205. Goshorn, D.M., and C.E. Epifanio. 1991. Diet of larval weakfish and prey abundance in Delaware Bay. Trans. Am. Fish. Soc. 120(6): 684-692.

206. Grant, G.C., and J.E. Olney. 1991. Distribution of striped bass, *Morone saxatilis*, (Walbaum), eggs and larvae in major Virginia rivers. Fish. Bull., U.S. 89(12): 20-23.

207. Gray, C.L. 1991. Bluefish (*Pomatomus saltatrix*) species profile. Rhode Island Dept. Environmental Management, Div. Fish and Wildlife, Marine Fisheries Sec. Narragansett Bay Project Rep. No. NPB-91-57. 52 p.

208. Gray, C.L. 1991. Scup (*Stenotomus chrysops*) species profile. Rhode Island Dept. Environmental Management, Div. Fish and Wildlife, Marine Fisheries Sec. Narragansett Bay Project Rep. No. NPB-91-76. 37 p.

209. Gray, C.L. 1991. Winter flounder (*Pseudopleuronectes americanus*) species profile. Rhode Island Dept. Environmental Management, Div. Fish and Wildlife, Marine Fisheries Sec. Narragansett Bay Project Rep. No. NPB-91-56. 69 p.

210. Grimes, B.H., M.T. Huish, J.H. Kerby, and D. Moran. 1989. Species profiles: life histories and environmental requirements of coastal fishes and invertebrates (Mid-Atlantic) - summer and winter flounder. U.S. Fish Wildl. Serv. Biol. Rep. 82(11.112). U.S. Army Corps of Engineers, TR EL-82-4. 18 p.

211. Grosslein, M.D., and T.R. Azarovitz. 1982. Fish Distribution. MESA New York Bight Atlas Monograph 15. N.Y. Sea Grant Inst., Albany, NY. 182 p.

212. Grover, R. 1982. Town of Babylon 1981 hard clam resource study. GPI Job No. 82318. Greenman-Pedersen, Inc., Babylon, NY.

213. Grover, R. 1983. Town of Babylon 1982 hard clam resource study. GPI Job No. 83340. Greenman-Pedersen, Inc., Babylon, NY.

214. Grover, R. 1985. Town of Babylon 1983 hard clam resource study. GPI Job No. 85309.00. Greenman-Pedersen, Inc., Babylon, NY.

215. Grover, R. 1987. Town of Babylon 1985/1986 hard clam resource study. GPI File No. 87346. Greenman-Pedersen, Inc., Babylon, NY.

216. Grover, R. 1988. Town of Babylon 1987 hard clam resource study. GPI File No. 88399. Greenman-Pedersen, Inc., Babylon, NY.

217. Grover, R. 1989. Town of Babylon 1988 hard clam resource study. GPI File No. 89379. Greenman-Pedersen, Inc., Babylon, NY.

218. Grover, R. 1990. Town of Babylon 1989 hard clam resource study. GPI File No. 90343. Greenman-Pedersen, Inc., Babylon, NY.

219. Gudger, E.W. 1908. Habits and life history of the oyster toadfish, *Opsanus tau*. Bull. U.S. Bur. Fish. 28: 1073-1109.

220. Haas, R.E. 1989. Technical report on aging of winter flounder otoliths from Rhode Island. Rhode Island Dept. Environmental Management, Providence, R.I. Narragansett Bay Project, Current Rep. No. NBP-89-24A. 27 p.

221. Haefner, P.A. 1976. Seasonal distribution and abundance of sand shrimp *Crangon septemspinosa* in the York River-Chesapeake Bay estuary. Chesapeake Sci. 17: 131-134.

222. Haefner, P.A.J. 1979. Comparative review of the biology of North Atlantic Caridean shrimps (*Crangon*), with emphasis on *C. septemspinosa*. Bull. Biol. Soc. Wash. 3: 1-40.

223. Hales, L.S., and M.J. Van Den Avyle. 1989. Species profiles: life histories and environmental requirements of coastal fishes and invertebrates (South Atlantic) - spot. U.S. Fish Wildl. Serv. Biol. Rep. 82(11.91). U.S. Army Corps of Engineers, TR EL-82-4. 24 p.

224. Hall, L.W., Jr. 1988. Studies of striped bass in three Chesapeake Bay spawning habitats. Mar. Pollut. Bull. 19(9): 466-477.

225. Hall, L.W., Jr., M.C. Ziegenfuss, S.J. Bushong, M.A. Unger, and R.L. Herman. 1989. Studies of contaminant and water quality effects on striped bass prolarvae and yearlings in the Potomac River and upper Chesapeake Bay in 1988. Trans. Am. Fish. Soc. 118(6): 619-629.

226. Halliwell, D.B. 1984. A List of the freshwater fishes of Massachusetts. Massachusetts Div. Fisheries and Wildlife. 12 p.

227. Hamilton, J. 1991. Beach seine survey, 1980-1990, averaged catch data and data summary. Unpublished data. Consolidated Edison Company of New York, Inc.

228. Hamilton, J. 1991. Fall shoal survey, 1983-1990, averaged catch data and data summary. Unpublished data. Consolidated Edison Company of New York, Inc.

229. Hamilton, J. 1991. Long River Ichthyoplankton Survey, 1982-1990, averaged catch data and data summary. Unpublished data. Consolidated Edison Company of New York, Inc.

230. Hardy, J.D., Jr. 1978. Development of fishes of the Mid-Atlantic Bight, an atlas of egg, larval, and juvenile stages. Volume II, Anguillidae through Syngnathidae. U.S. Fish Wildl. Serv., Ofc. Biol. Serv. FWS/OBS-78/12. 458 p.

231. Hardy, J.D., Jr. 1978. Development of fishes of the Mid-Atlantic Bight, an atlas of egg, larval, and juvenile stages. Volume III, Aphredoderidae through Rachycentridae. U.S. Fish Wildl. Serv., Ofc. Biol. Serv. FWS/OBS-78/12. 394 p.

232. Hastings, R.W. 1984. The fishes of the Mullica River, a naturally acid water system of the New Jersey Pine Barrens. Bull. N.J. Acad. Sci. 29(1): 9-23.

233. Hastings, R.W., J.C. O'Herron Jr., K. Schick, and M.A. Lazzari. 1987. Occurrence and distribution of shortnose sturgeon, *Acipenser brevirostrum*, in the upper tidal Delaware River. Estuaries 10(4): 337-341.

234. Hattala, K. 1991. Trawl Survey of Hudson River, 1981-1990. Unpublished data. N.Y. Dept. Environmental Conservation, New Paltz, NY.

235. Haven, D. 1987. The American oyster, *Crassostrea virginica*, in Chesapeake Bay. Contaminant Problems and Management of Living Chesapeake Bay Resources. pp 165-176.

236. Haven, D., and L.W. Fritz. 1985. Setting of the American oyster *Crassostrea virginica* (Gmelin) in the James River, Virginia: The temporal-spatial distribution. J. Shellfish Res. 5(1): 38.

237. Haven, D.S. 1976. The shellfish fisheries of the Potomac River. *In* Mason, W.T., and K.C. Flynn (eds.). The Potomac Estuary: Biological Resources, Trends, and Options. Proceedings of a symposium sponsored by Interstate Commission on the Potomac River Basin and Power Plant Siting Program, Maryland Dept. Nat. Res. ICPRB Tech. Pub. 76-2, Bethesda, MD.

238. Haven, D.S., and J.P. Whitcomb. 1983. The origin and extent of oyster reefs in the James River, Virginia. J. Shellfish Res. 3(2): 141-151.

239. Havens, K.J., and J.R. McConaugha. 1990. Molting in the mature female blue crab, *Callinectes sapidus*. Bull. Mar. Sci. 46(1): 37-47.

240. Haynes, E.B., and R.L. Wigley. 1969. Biology of the northern shrimp, *Pandalus borealis*, in the Gulf of Maine. Trans. Am. Fish. Soc. 98: 60-76.

241. Heck, K.L., Jr., K.W. Able, M.P. Fahay, and C.T. Roman. 1989. Fishes and decapod crustaceans of Cape Cod eelgrass meadows: Species composition, seasonal abundance patterns and comparison with unvegetated substrates. Estuaries 12: 59-65.

242. Heck, K.L., Jr., and R.J. Orth. 1980. Structural components of eelgrass (*Zostera marina*) meadows in the Lower Chesapeake Bay - decapod crustacea. Estuaries 3(4): 289-295.

243. Hedgepeth, M.Y. 1983. Age, growth, and reproduction of American eels, *Anguilla rostrata* from the Chesapeake Bay. M.A. thesis, Virginia Inst. Marine Science, Coll. William and Mary, Gloucester Pt., VA. 61 p.

244. Helfman, G.S., D.E. Facey, L.S. Hales, Jr., and E.L. Bozeman, Jr. 1987. Reproductive Ecology of the American Eel. *In* Dadswell, M.J., R.J. Klauda, C.M. Moffitt, R.L. Saunders, R.A. Rulifson, and J.E. Cooper (eds.), pp. 42-56. Common Strategies of Anadromous and Catadromous Fishes. American Fisheries Society Symposium 1. American Fisheries Society, Bethesda, MD. 561 p.

245. Herman, S.S. 1958. Planktonic fish eggs and larvae of Narragansett Bay. M.S. thesis, Univ. Rhode Island, Kingston, RI.

246. Herman, S.S. 1963. Planktonic fish eggs and larvae of Narragansett Bay. Limnol. Oceanogr. 8: 103-109.

247. Hickey, C.R. 1975. Pound net catches of warm-water fishes at Montauk, New York. N.Y. Fish Game J. 22: 38-50.

248. Hickey, C.R. 1985. Survey of the technical literature on the marine finfishery resources of the Peconic/Gardiners Bay system, New York, 1900-1984, with recommendations for resource conservation and study. Spec. Rep. 65, Ref. 85-20. State Univ. New York, Marine Sciences Research Center, Stony Brook, NY. 106 p.

249. Hickey, J.M. 1983. Assessment of quahog stocks in contaminated waters of southeastern Massachusetts. Pub. No. 136-92-50-6-84-C.R. Massachusetts Div. Marine Fisheries, Boston, MA. 31 p.

250. Hildebrand, S.F., and W.C. Schroeder. 1928. Fishes of Chesapeake Bay. U.S. Bureau of Fisheries, Fish. Bull. 43: 1-366.

251. Hildebrand, S.F., and W.C. Shroeder. 1972. Fishes of Chesapeake Bay, 5th edition. U.S. Fish Wildl. Serv., Washington, DC. 388 p.

252. Hill, J., J.W. Evans, and M.J. Van Den Avyle. 1989. Species profiles: life histories and environmental requirements of coastal fishes and invertebrates (South Atlantic) - striped bass. U.S. Fish Wildl. Serv. Biol. Rep. 82(11.118). U.S. Army Corps of Engineers, TR EL-82-4. 35 p.

253. Hill, J., D.L. Fowler, and M.J. Van Den Avyle. 1989. Species profiles: life histories and environmental requirements of coastal fishes and invertebrates (Mid-Atlantic) - blue crab. U.S. Fish Wildl. Serv. Biol. Rep. 82(11.100). U.S. Army Corps of Engineers, TR EL-82-4. 18 p.

254. Hilliman, N.S. 1964. Studies on the distribution and abundance of decapod larvae in Narragansett Bay, Rhode Island, with consideration of morphology and mortality. M.S. thesis, Univ. Rhode Island, Kingston, RI. 74 p.

255. Himchak, P.J. 1982. Distribution and abundance of larval and young finfishes in the Maurice River and in waterways near Atlantic City, New Jersey. M.S. thesis, Rutgers Univ., New Brunswick, NJ.

256. Hines, A.H., and K.L. Comtois. 1983. Predation by blue crabs and spot on infaunal communities in central Chesapeake Bay. J. Shellfish Res. 3(1): 93.

257. Hines, A.H., A.M. Haddon, and L.A. Wiechert. 1990. Guild structure and foraging impact of blue crabs and epibenthic fish in a subestuary of Chesapeake Bay. Mar. Ecol. Prog. Ser. 67(2): 105-126.

258. Hines, A.H., and R.N. Lipcius. 1990. Blue crab predation on clams: Effects of species, sediment, density and siphon nipping. Bull. Mar. Sci. 46(1): 246.

259. Hines, A.H., R.N. Lipcius, and A.M. Haddon. 1987. Population dynamics and habitat partitioning by size, sex, and molt stage of blue crabs, *Callinectes sapidus*, in a subestuary of central Chesapeake Bay. Mar. Ecol. Prog. Ser. 36(1): 55-64.

260. Hines, A.H., K.E. Osgood, and J.J. Miklas. 1985. Semilunar reproductive cycles in *Fundulus heteroclitus* (Pisces: Cyprinodontidae) in an area without lunar tidal cycles. Fish. Bull., U.S. 83(3): 467-472.

261. Hixon, D.J. 1980. The determination of the acute toxicity, uptake and elimination rates of kepone by *Crangon septimspinosa*. M.A. thesis, Virginia Inst. Marine Science, Coll. William and Mary, Gloucester Pt., VA. 77 p.

262. Hoff, J.G. 1972. Movements of adult tidewater silverside, *Menidia beryllina*, tagged in New England waters. Am. Midl. Naturalist 88(2): 499-502.

263. Hoff, J.G. 1985. Comparison of daily growth rates of the mummichog, *Fundulus heteroclitus*, in habitats of different salinity regimes. M.A. thesis, Virginia Inst. Marine Science, Coll. William and Mary, Gloucester Pt., VA.

264. Hoff, J.G., and R.M. Ibara. 1977. Factors affecting the seasonal abundance, composition and diversity of fishes in a southeastern New England estuary. Estuarine Coastal Mar. Sci. 5: 665-678.

265. Howe, A.B. 1971. Biological investigation of Atlantic tomcod, *Microgadus tomcod*, in the Weweantic River estuary, Massachusetts, 1967. M.S. thesis, Univ. Massachusetts, Amherst, MA. 82 p.

266. Howe, A.B., and P.G. Coates. 1975. Winter flounder movements, growth, and mortality off Massachusetts. Trans. Am. Fish. Soc. 104: 13-29.

267. Howe, A.B., P.G. Coates, and D.E. Pierce. 1976. Winter flounder estuarine year-class abundance, mortality, and recruitment. Trans. Am. Fish. Soc. 105: 647-657.

268. Howe, A.B., T.P. Currier, S.J. Correia, and D.B. Witherell. 1991. Fishery Resource Assessment, Coastal Massachusetts, 1990. NOAA/NMFS Sub-Project No. 3-IJ-3. 15 p.

269. Howe, A.B., T.P. Currier, S.L. Sass, and B.C. Kelly. 1987. Fishery Resource Assessment, Coastal Massachusetts, 1985. NOAA/NMFS Sub-Project No. 3-375-R-3. 30 p.

270. Howe, S., D. Maurer, and W. Leathem. 1988. Secondary production of benthic molluscs from the Delaware Bay and Coastal Area. Estuarine Coastal Shelf Sci. 26: 81-94.

271. Howell, M.H., J.P. Mowrer, R.J. Hochberg, T.A. Jarzynski, and D.R. Weinrich. 1990. Investigation of Anadromous Alosids in Chesapeake Bay. Completion report F-37-R. U.S. Fish and Wildlife Service. 106 p.

272. Howell, P.T. 1990. Long Island Sound Finfish Survey (Trawls). Connecticut Dept. Environmental Protection, Div. Marine Fisheries.

273. Hyer, P.V., J.P. Jacobson, and C.S. Fang. 1975. Index of existing data sources for Chincoteague, Sinepuxent, Assawoman, and Little Assawoman Bays. Report to the Maryland Dept. of Natural Resources. 72 p.

274. Idyll, C.P., and W.E. Fahy. 1975. Spotted seatrout - shallow water sport fish. Atlantic States Marine Fisheries Commission, Leaflet No. 13.

275. Itzkowitz, M. 1974. The effects of other fish on the reproductive cycle of male *Cyprinodon variegatus*. Behav. Int. J. Comp. Ethol. 68: 1-2.

276. Jacobs, R. 1992. Catch/effort of all sizes of fish captured by electrofishing from selected tidal Connecticut River mainstem sites between 1988 and 1991. Unpublished data. Connecticut Dept. Environmental Protection, Hartford, CT.

277. Jeffries, H.P., and M. Terceiro. 1985. Cycle of changing abundances in the fishes of the Narragansett Bay area. Mar. Ecol. Prog. Ser. 25: 239-244.

278. Jeffries, P., S. Hale, and A. Keller. 1988. Historical data assessment of finfishes of the Narragansett Bay area. Univ. Rhode Island, Graduate School of Oceanography, Narragansett, RI. Narragansett Bay Project Rep. No. NBP-89-15. 407 p.

279. Jeffries, P., A. Keller, and S. Hale. 1989. Predicting winter flounder catches by time series analysis. Can. J. Fish. Aquat. Sci. 46: 650-659.

280. Jensen, A.C. 1974. New York's fisheries for scup, summer flounder, and black sea bass. N.Y. Fish Game J. 21(2): 126-134.

281. Jensen, L.D. 1974. Environmental responses to thermal discharges from the Indian River station, Indian River, Delaware. Report No. 12, Chapter 6. 63 p.

282. Jinks, S.M., and W.P. Dey. 1991. 1989 Year Class Report for the Hudson River Estuary Monitoring Program. EA Engineering, Science, and Technology, Newburgh, NY. Prepared for Consolidated Edison Co. of New York, Inc.

283. Johnson, D.R., and B.S. Hester. 1989. Larval transport and its association with recruitment of blue crabs to Chesapeake Bay. Estuarine Coastal Shelf Sci. 28(5): 459-472.

284. Johnson, D.R., and W.J. Seaman. 1986. Species profiles: life histories and environmental requirements of coastal fishes and invertebrates (South Florida) - spotted seatrout. U.S. Fish Wildl. Serv. Biol. Rep. 82(11.43). U.S. Army Corps of Engineers, TR EL-82-4. 18 p.

285. Johnson, G.D. 1978. Development of fishes of the Mid-Atlantic Bight, an atlas of egg, larval, and juvenile stages. Volume IV, Carangidae through Ephippidae. U.S. Fish Wildl. Serv., Ofc. Biol. Serv. FWS/OBS-78/12. 314 p.

286. Jones, C.M., J.R. McConaugha, P.J. Geer, and M.H. Prager. 1990. Estimates of spawning stock size of blue crab, *Callinectes sapidus*, in Chesapeake Bay, 1986-1987. Bull. Mar. Sci. 46(1): 159-169.

287. Jones, P.W., F.D. Martin, and J.D. Hardy, Jr. 1978. Development of fishes of the Mid-Atlantic Bight, an atlas of egg, larval, and juvenile stages. Volume I, Acipenseridae through Ictaluridae. U.S. Fish Wildl. Serv., Ofc. Biol. Serv. FWS/OBS-78/12. 366 p.

288. Joseph, E.B. 1972. The status of the Sciaenid stocks of the middle Atlantic coast. Chesapeake Sci. 13(2): 87-100.

289. Joseph, E.B., W.H. Massman, and J.J. Norcross. 1964. The pelagic eggs and early larval stages of the black drum from Chesapeake Bay. Copeia 1964(2): 425-434.

290. Joseph, J.W. 1982. Assessment of the hard clam resource supporting the 1980 relay program. N.J. Dept. Environmental Protection, Div. Fish, Game, and Shellfisheries, Nacote Creek Shellfish Office. Misc. Rep. No. SF-9.

291. Juanes, F., R.E. Marks, K.A. McKown, and D.O. Conover. 1993. Predation by age-0 bluefish on age-0 anadromous fishes in the Hudson River estuary. Trans. Am. Fish. Soc. 122(3): 348-356.

292. June, F.C., and W.R. Nicholson. 1964. Age and size composition of the menhaden catch along the Atlantic Coast of the United States, 1958. U.S. Fish Wildl. Serv., Spec, Sci. Rep. - Fisheries No. 446. U.S. Dept. Interior, Washington, DC.

293. Karnofsky, E.B., J. Atema, and R.H. Elgin. 1989. Field observations of social behavior, shelter use, and foraging in the lobster, *Homarus americanus*. Biol Bull. (Woods Hole) 176: 239-246.

294. Karnofsky, E.B., J. Atema, and R.H. Elgin. 1989. Natural dynamics of population structure and habitat use of the lobster, *Homarus americanus*, in a shallow cove. Biol. Bull. (Woods Hole) 176: 247-256.

295. Kassner, J., and R.E. Malouf. 1982. An evaluation of "spawner transplants" as a management tool in Long Island's hard clam fishery. J. Shellfish Res. 2: 165-172.

296. Kassner, J., R. Cerrato, and T. Carrano. 1990. Toward understanding and improving the abundance of quahogs (*Mercenaria mercenaria*) in the Eastern Great South Bay, New York. *In* Rice, M. (ed.), pp. 69-78. First Rhode Island Shellfisheries Conference. Rhode Island Sea Grant, Narragansett, RI.

297. Kelly, K.H., and J.R. Moring. 1986. Species profiles: life histories and environmental requirements of coastal fishes and invertebrates (North Atlantic) - Atlantic herring. U.S. Fish Wildl. Serv. Biol. Rep. 82(11.38). U.S. Army Corps of Engineers, TR EL-82-4. 22 p.

298. Kendall, A.W., Jr., and L.A. Walford. 1979. Sources and distribution of bluefish, *Pomatomus saltatrix*, larvae and juveniles off the East Coast of the United States. Fish. Bull., U.S. 77(1): 213-227.

299. Kennedy, V.S. 1982. Environmental influences on sex ratios and spawning in oysters. J. Shellfish Res. 2(1): 100.

300. Kennedy, V.S., and J.A. Mihursky. 1972. Effects of temperature in the respiratory metabolism of three Chesapeake bivalves. Chesapeake Sci. 13: 1-22.

301. Kennish, M.J., D.J. Danila, and R.J. Hillman. 1982. Assessment of the blue crab, *Callinectes sapidus*, in Barnegat Bay, New Jersey. Bull. N.J. Acad. Sci. 27(2): 59-71.

302. Kennish, M.J., and R.A. Lutz (eds.). 1984. Ecology of Barnegat Bay, New Jersey. Springer-Verlag, New York, NY.

303. Kernehan, R.J., M.R. Headrick, and R.E. Smith. 1981. Early life history of striped bass in the Chesapeake and Delaware Canal and vicinity. Trans. Am. Fish. Soc. 110: 137-150.

304. Keser, M., and L. Birely. 1991. Monitoring the marine environment of Long Island Sound at Millstone Nuclear Power Station: Annual Report 1990. Northeast Utilities, Hartford, CT. 270 p.

305. Keser, M., and L. Birely. 1992. Monitoring the Marine Environment of Long Island Sound at Millstone Nuclear Power Station: Annual Report 1991. Northeast Utilities Environmental Laboratory, Waterford, CT. 331 p.

306. Keser, M., D.F. Landers, and D.M. Jeffrey. 1983. Population Characteristics of the American lobster, *Homarus americanus*, in Eastern Long Island Sound, Connecticut. NOAA Tech. Rep. NMFS SSRF-770.

307. Killgore, K.J., R.P. Morgan, and N.B. Rybicki. 1989. Distribution and abundance of fishes associated with submersed aquatic plants in the Potomac River. N. Am. J. Fish. Mgmt. 9: 101-111.

308. Kissil, G.W. 1974. Spawning of the anadromous alewife, *Alosa pseudoharengus*, in Bride Lake, Connecticut. Trans. Am. Fish. Soc. 2: 312-317.

309. Klein-MacPhee, G., and A.G. Durbin. 1991. An Ichthyoplankton Survey of Narragansett Bay with Emphasis on the National Estuarine Research Reserve Sanctuary. Univ. Rhode Island, Graduate School of Oceanography. 110 p.

310. Kline, L.L. 1990. Population dynamics of young-of-the-year striped bass, *Morone saxatilis*, populations, based on daily otolith increments. Ph.D dissertation, Virginia Inst. Marine Science, Coll. William and Mary, Gloucester Pt., VA.

311. Kneib, R.T. 1987. Seasonal abundance, distribution and growth of postlarval and juvenile grass shrimp (*Paleaemonetes pugio*) in a Georgia, USA, salt marsh. Mar. Biol. 96: 215-223.

312. Knotts, K.S. 1990. Preliminary information on the population dynamics of the blue crab in Chesapeake Bay based on field sampling of the commercial fishery. Bull. Mar. Sci. 46(1): 246.

313. Kolek, A., and T. Currier. 1980. Feasibility of a pot fishery for scup in Buzzards Bay. Massachusetts Div. Marine Fisheries. 24 p.

314. Koo, T.S.Y. 1967. Commercial Fisheries Research and Development Act: Final report for contract year ending August 31, 1967. Univ. of Md., Nat. Res. Inst. Ref. No. 67-6-C.

315. Koo, T.S.Y. 1973. Winter flounder. *In* Lippson, A.J. (ed.), p. 46-47. The Chesapeake Bay in Maryland: An Atlas of Natural Resources. Johns Hopkins Univ. Press, Baltimore, MD.

316. Krantz, G., and M. Oxford. 1990. Maryland Oyster Spat Survey, 1970-1989. Md. Dept. Natural Resources, Div. Fish and Wildlife.

317. Kriete, W.H, Jr. 1980. Index of juvenile striped bass, white perch, and alosine fishes in the Rappahannock River following the March 1980 oil spill. Grant Report, Virginia Inst. Marine Science, Coll. William and Mary, Gloucester Pt., VA.

318. Kriete, W.H., Jr. 1983. Status of American shad stocks in Virginia. Special Report in Applied Marine Science and Ocean Engineering (SRAMSOE) No. 269. Virginia Inst. Marine Science, Gloucester Pt., VA.

319. Kroger, R.L., and J.F. Guthrie. 1973. Migrations of tagged juvenile Atlantic menhaden. Trans. Am. Fish. Soc. 102: 417-422.

320. Kvaternik, A.C. 1982. Analysis of population and price aspects of the Virginia hard clam (*Mercenaria mercenaria*) fishery. M.A. thesis, Virginia Inst. Marine Science, Coll. William and Mary, Gloucester Pt., VA. 103 p.

321. Kvaternik, A.C., and W.D. Dupaul. 1983. Estimation of standing crop of *Mercenaria mercenaria* in the James River, Virginia, using commercial records. J. Shellfish Res. 3(1): 96.

322. Kynard, B., and J.P. Warner. 1987. Spring and summer movements of subadult striped bass, *Morone saxatilis*, in the Connecticut River. Fish. Bull., U.S. 85: 143-147.

323. Lanier, J.A. III. 1971. Catfish management in the James River, Virginia. M.A. thesis, Virginia Inst. Marine Science, Coll. William and Mary, Gloucester Pt., VA. 28 p.

324. Larson, S.C., M.J. Van Den Avyle, and E.L.J. Bozeman. 1989. Species profiles: life histories and environmental requirements of coastal fishes and invertebrates (South Atlantic) - brown shrimp. U.S. Fish Wildl. Serv. Biol. Rep. 82(11.90). U.S. Army Corps of Engineers, TR EL-82-4. 14 p.

325. Lassen, T.J. 1983. Striped bass management in the Chesapeake Bay. M.A. thesis, Virginia Inst. Marine Science, Coll. William and Mary, Gloucester Pt., VA.

326. Lassuy, D.R. 1983. Species profiles: life histories and environmental requirements of coastal fishes and invertebrates (Gulf of Mexico) - Atlantic croaker. U.S. Fish Wildl. Serv. Biol. Rep. 82 (11.3). U.S. Army Corps of Engineers, TR EL-82-4. 12 p.

327. Lassuy, D.R. 1983. Species profiles: life histories and environmental requirements of coastal fishes and invertebrates (Gulf of Mexico) - brown shrimp. U.S. Fish Wildl. Serv. Biol. Rep. 82(11.1). U.S. Army Corps of Engineers, TR EL-82-4.

328. Lassuy, D.R. 1983. Species profiles: life histories and environmental requirements of coastal fishes and invertebrates (Gulf of Mexico) - spotted seatrout. U.S. Fish Wildl. Serv. Biol. Rep. 82(11.4). U.S. Army Corps of Engineers, TR EL-82-4.

329. Lawton, R.P. 1974. A literature review of the Bluefish with emphasis on populations in Buzzards Bay, Massachusetts. M.S. thesis, Southeastern Massachusetts Univ., Dartmouth, MA. 24 p.

330. Lazzari, M.A., and K.W. Able. 1990. Northern pipefish, *Syngnathus fuscus*, occurrences over the Mid-Atlantic Bight continental shelf: evidence of seasonal migration. Environ. Biol. Fishes 27:177-185.

331. Lazzari, M.A., J.C. O'Herron Jr., and R.W. Hastings. 1986. Occurrence of juvenile Atlantic sturgeon, *Acipenser oxyrhynchus*, in the upper tidal Delaware River. Estuaries 9(4B): 356-361.

332. Leathem, W., and D. Maurer. 1980. Decapod crustaceans of the Delaware Bay area. J. Nat. Hist.14: 813-828.

333. Lebida, R.C. 1969. The seasonal abundance and distribution of eggs, larvae and juvenile fishes in the Weweantic River Estuary, Massachusetts, 1966. M.S. thesis, Univ. Massachusetts, Amherst, MA. 59 p.

334. Leggett, W.C. 1976. The American shad (*Alosa sapidissima*), with special reference to its migration and population dynamics in the Connecticut River. *In* Merriman, D., and L.M. Thorpe (eds.), pp. 169-225. The Connecticut River Ecological Study. American Fisheries Society Monograph 1. American Fisheries Society, Bethesda, MD. 252 p.

335. Levesque, R.C. 1970. The relationship of available fauna to the food intake of young-of-the-year American shad (*Alosa sapidissima*), in the Connecticut River above Holyoke, Massachusetts. M.S. thesis, Univ. Massachusetts, Amherst, MA. 32 p.

336. Lipcius, R.N., E.J. Olmi, III, and J. Van Montfrans. 1990. Planktonic availability, molt stage, and settlement of blue crab postlarvae. Mar. Ecol. Prog. Ser. 58(3): 235-242.

337. Lipcius, R.N., E.J. Olmi, III, and J. Van Montfrans. 1990. Regulatory mechanisms of postlarval blue crab recruitment: Settlement, metamorphosis and developmental state. Bull. Mar. Sci. 46(1): 247

338. Lipcius, R.N., and W.A. Van Engel. 1990. Blue crab population dynamics in Chesapeake Bay: Variation in abundance (York River, 1972-1988) and stock-recruit functions. Bull. Mar. Sci. 46(1): 180-194.

339. Lippson, A.J. 1973. The Chesapeake Bay in Maryland: An Atlas of Natural Resources. The Johns Hopkins Univ. Press, Baltimore, MD. 55 p.

340. Lippson, A.J., M.S. Haire, A.F. Holland, F. Jacobs, J. Jenson, R.L. Moran-Johnson, T.T. Polgar, and W.A. Richkus. 1979. Environmental Atlas of the Potomac Estuary. Martin Marietta Corp. Environmental Ctr., Baltimore, MD. Prep. for Md. Dept. Nat. Res., Power Plant Siting Program. 280 p., 9 maps.

341. Lippson, A.J., and R.L. Lippson. 1984. Life in the Chesapeake Bay. The Johns Hopkins Univ. Press, Baltimore, MD. 229 p.

342. Lippson, A.J., and R.L. Moran. 1974 Manual for identification of early developmental stages of fishes of the Potomac River estuary. Prepared for Power Plant Siting Program, Md. Dept. Natural Resources, by Martin Marietta Corp., Env. Tech. Ctr., Baltimore, MD. PPSP-MP-13.

343. Lippson, R.L. 1971. Blue crab study in Chesapeake Bay, Maryland: Annual progress report. Univ. of Md. Natural Resources Institute, Chesapeake Biological Laboratory, Solomons, MD. Ref. No. 71-9.

344. Lipton, D.W. 1979. Comparison of scales and otoliths for determining age and growth of the alewife (*Alosa pseudoharengus*). M.A. thesis, Virginia Inst. Marine Science, Coll. William and Mary, Gloucester Pt., VA. 37 p.

345. Llanso, R.J. 1986. Macrobenthic community structure at the entrance to the Chesapeake Bay. M.A. thesis, Virginia Inst. Marine Science, Coll. William and Mary, Gloucester Pt., VA.

346. Loesch, J.G. 1987. Overview of life history aspects of andromous alewife and blueback herring in freshwater habitats. *In* Dadswell, M.J., R.J. Klauda, C.M. Moffitt, R.L. Saunders, R.A. Rulifson, and J.E. Cooper (eds.), Common Strategies of Anadromous and Catadromous Fishes, pp. 89-100. American Fisheries Society Symposium 1. American Fisheries Society, Bethesda, MD. 561 p.

347. Loesch, J.G., and W.H. Kriete, Jr. 1984. Study of *Alosa* stock composition and year-class strength in Virginia. Annual Report, Anadromous Fish Project 1984, Project No. AFC 13-1. Virginia Inst. Marine Science, School of Marine Science, College of William and Mary, Gloucester Pt., VA.

348. Loesch, J.G., W.H. Kriete, Jr., and R.P. Trapani. 1986. Study of *Alosa* stock composition and year-class strength in Virginia. Annual Report, Anadromous Fish Project 1985, Project No. AFC 13-2. Virginia Inst. Marine Science, Coll. William and Mary, Gloucester Pt., VA.

349. Loesch, J.G., W.H. Kriete, Jr., and R.P. Trapani. 1987. Study of *Alosa* stock composition and year-class strength in Virginia. Completion Report, Anadromous Fish Project 1984-1986, Project No. AFC 13-1-3. Virginia Inst. Marine Science, School of Marine Science, College of William and Mary, Gloucester Pt., VA.

350. Loesch, J.G., and W.A. Lund. 1977. A contribution to the life history of the blueback herring, *Alosa aestivalis*. Trans. Am. Fish. Soc. 106: 583-589.

351. Logan, D.T. 1985. Environmental variation and striped bass population dynamics: a size-dependent mortality model. Estuaries 8: 28-38.

352. Long, D., and W. Figley. 1982. New Jersey's Recreational and Commercial Fishing Grounds. N.J. Dept. Environmental Protection. Tech. Ser. 82-1.

353. Loos, J. 1975. Shore and tributary distribution of ichthyoplankton and juvenile fish with a study of their food habits. Prepared for Md. Dept. Nat. Res., Power Plant Siting Program. Academy of Natural Sciences of Philadelphia, Philadelphia, PA.

354. Loveland, R.E., P. Edwards, J.J. Vouglitois, and D. Palumbo. 1974. The qualitative and quantitative analysis of the benthic flora and fauna of Barnegat Bay before and after the onset of thermal addition. Rutgers Univ., Contract No. 27-4656 for Jersey Central Power and Light, Prog. Rep. No. 9.

355. Lucy, J.A. 1976. The reproductive cycle of *Mya arenaria* and distribution of juvenile clams in the upper portion of the nearshore zone of the York River, Virginia. M.A. thesis, Virginia Inst. Marine Science, Coll. William and Mary, Gloucester Pt., VA. 131 p.

356. Lund, W.A., and G.C. Maltezos. 1970. Movements and migrations of the bluefish, *Pomatomus saltatrix*, tagged in waters of New York and southern New England. Trans. Am. Fish. Soc. 4: 719-726.

357. Lund, W.A., and L.L. Stewart. 1970. Abundance and distribution of larval lobsters off the coast of southern New England. Proc. Natl. Shellfish Assoc. 60: 40-49.

358. Luo, J. 1991. Life history of the bay anchovy, *Anchoa mitchilli*, in Chesapeake Bay. Ph.D. dissertation, Virginia Inst. Marine Science, Coll. William and Mary, Gloucester Pt., VA.

359. Lux, F.E., P.E. Hamer, and J.C. Poole. 1966. Summer flounder. Marine Resources of the Atlantic Coast. Atl. St. Mar. Fish. Comm., Tallahassee, Fla. Leaflet No. 6.

360. Lux, F.E., and F.E. Nichy. 1971. Number and lengths, by season, of fishes caught with an otter trawl near Woods Hole, Massachusetts, September 1961 to December 1962. NOAA/NMFS Spec. Sci. Rep. - Fisheries No. 622. 15 p.

361. Lux, F.E., and C.L. Wheeler. 1993. Larval and juvenile fishes caught in a neuston survey of Buzzards Bay, Massachusetts. NOAA/NMFS-NEFC, Woods Hole, MA. 16 p.

362. Lynch, J.M., D.M. Byrne, D.E. Ashton, B.M. Allen, A. Heyl, R. Markowski, and T.W. Woithe. 1977. Impingement and entrainment at the Werner generating station and a study of the fishes of the Raritan River and Bay near the station: April 1976 - March 1977. Ichthyological Associates, Inc., Ithaca, NY. Prepared for New Jersey Central Power and Light Company. 281 p.

363. Lynch, T.R. 1987. Coastal Fishery Resource Assessment, Trawl Survey. Rhode Island Dept. Environmental Management, Div. Fish and Wildlife, Marine Fisheries Section. Annual Progress Report 1987. 40 p.

364. Lynch, T.R. 1991. Coastal Fishery Resource Assessment, Trawl Survey, 1979-1991. Unpublished data. Rhode Island Dept. Environmental Management, Div. Fish and Wildlife, Marine Fisheries Section.

365. MacGregor, J.S. 1950. Some hydrographic conditions found in winter in lower Chesapeake Bay and their possible effects on the blue crab (*Callinectes sapidus*) population. M.A. thesis, Virginia Inst. Marine Science, Coll. William and Mary, Gloucester Pt., VA. 56 p.

366. MacKenzie, C., and J.R. Moring. 1985. Species profiles: life histories and environmental requirements of coastal fishes and invertebrates (North Atlantic) - American lobster. U.S. Fish Wildl. Serv. Biol. Rep. 82(11.33). U.S. Army Corps of Engineers, TR EL-82-4.

367. MacKenzie, C., L.S. Weiss-Glanz, and J.R. Moring. 1985. Species profiles: life histories and environmental requirments of coastal fishes and invertebrates (mid-Atlantic) - American shad. U.S. Fish Wildl. Serv. Biol. Rep. 82(11.37). U.S. Army Corps of Engineers, TR EL-82-4. 18 p.

368. MacKenzie, C.L. 1981. Biotic potential and environmental resistance in the Amercian oyster (*Crassostrea virginica*) in Long Island Sound. Aquaculture 22: 229-269.

369. MacKenzie, C.L. 1989. A guide for enhancing estuarine molluscan shellfisheries. Mar. Fish. Rev. 51(3): 1-47.

370. MacKenzie, C.L. 1990. History of the fisheries of Raritan Bay, New York and New Jersey. Mar. Fish. Rev. 52(4): 1-45.

371. MacLean, S.A. 1981. The Chesapeake ray. Underwater Nat. 13(3): 31-33.

372. MacLeod, R.E., D.G. Simpson, P.T. Howell, and M.W. Johnson. 1990. A Study of Marine Recreational Fisheries in Connecticut, 1984-1988. Federal Aid to Sport Fish Restoration F54R Final Report. Connecticut Dept. Environmental Protection, Div. Marine Fisheries. 265 p.

373. MacLeod, R.E., D.G. Simpson, M.W. Johnson, K. Gottschall, and P.T. Howell. 1991. A study of marine recreational fisheries in Connecticut. Connecticut Dept. Environmental Protection, Div. Marine Fisheries. 80 p.

374. Makai, J.F. 1973. Phase II: Chemical-physical studies. *In* Studies of the Upper Barnegat system. N.J. Dept. Environmental Protection. Misc. Rep. No. 10M.

375. Mann, J.M. 1974. Some aspects of the biology of the searobins *Prionotus carolinus* and *Prionotus evolans*. M.S. thesis, Long Island Univ., Long Island, NY.

376. Mansour, R.A., R.N. Lipcius, and A.H. Hines. 1988. Spatial aspects of foraging in *Callinectes sapidus* - implications for soft-sediment marine benthic predator-prey dynamics. J. Shellfish Res. 7(1): 195-196.

377. Mansueti, A.J., and J.D. Hardy, Jr. 1967. Development of Fishes of the Chesapeake Bay Region, Part I: An Atlas of Egg, Larval and Juvenile Stages. Univ. Maryland, Natural Resources Inst., Chesapeake Biological Lab., Solomons, MD. 202 p.

378. Mansueti, R.J. 1955. Natural history of the American shad in Maryland waters. Reprinted from Maryland Tidewater News 11(11), Suppl. No. 4. Univ. Maryland, Natural Resources Inst., Chesapeake Biological Lab., Solomons, MD.

379. Mansueti, R.J. 1960. Restriction of very young red drum, *Sciaenops ocellata*, to shallow estuarine waters of Chesapeake Bay during late autumn. Chesapeake Sci. 1(3-4): 207-210.

380. Marcy, B.C. 1976. Early life history studies of American shad in the lower Connecticut River and the effects of the Connecticut Yankee plant. *In* Merriman, D., and L.M. Thorpe (eds.), pp. 141-161. The Connecticut River Ecological Study. American Fisheries Society Monograph 1. American Fisheries Society, Bethesda, MD. 252 p.

381. Marcy, B.C. 1976. Fishes of the lower Connecticut River and the effects of the Connecticut Yankee Plant. *In* Merriman, D., and L.M. Thorpe (eds.), pp. 61-114. The Connecticut River Ecological Study. American Fisheries Society Monograph 1. American Fisheries Society, Bethesda, MD. 252 p.

382. Marcy, B.C. 1976. Planktonic fish eggs and larvae of the lower Connecticut River and the effects of the Connecticut Yankee Plant including entrainment. *In* Merriman, D., and L.M. Thorpe (eds.), pp. 115-139. The Connecticut River Ecological Study. American Fisheries Society Monograph 1. American Fisheries Society, Bethesda, MD. 252 p.

383. Marcy, B.C., R.G. Ford, and F.D. Scribner. 1968. Egg and larval descriptions, shad spawning areas, juvenile shad, plankton, and resident fish program. Unpublished manuscript. 80 p.

384. Margulies, D. 1989. Effects of food concentration and temperature on development, growth, and survival of white perch, *Morone americana*, eggs and larvae. Fish. Bull., U.S. 87(1): 63-72.

385. Maris, R.C. 1990. Dispersal-recruitment mechanisms of *Callinectes sapidus* involving larval and postlarval patterns of diurnal vertical distribution in the vicinity of the Chesapeake Bay, Virginia. Bull. Mar. Sci. 46(1): 247.

386. Markle, D.F., D.A. Methven, and L.J. Coates-Markle. 1982. Aspects of spatial and temporal cooccurrence in the life history stages of the sibling hakes, *Urophycis chuss* (Waldbaum 1792) and *Urophycis tenuis* (Mitchill 1815) (Pisces: Gadidae). Can. J. Zool. 60: 2057-2078.

387. Marshall, N.B. 1946. Observations on the ecology and life history of two searobins, *Prionotus carolinus* and *Prionotus evolans strigatus*. Copeia 1946(3): 118-144.

388. Martel, G., and J.M. Green. 1987. Differential spawning success among territorial male cunners, *Tautogolabrus adspersus* (Labridae). Copeia 1987(3): 643-648.

389. Martin, C.M. 1972. Collection of biological samples from Delaware's tidal streams. Delaware Dept. Natural Resources and Environmental Control. Job No. II-3, Project No. F-22-R-2. 26 p.

390. Martin, F.D., and G.E. Drewry. 1978. Development of fishes of the Mid-Atlantic Bight, an atlas of egg, larval, and juvenile stages. Volume VI, Stromateidae through Ogcocephalidae. U.S. Fish Wildl. Serv., Ofc. Biol. Serv. FWS/OBS-78/12. 416 p.

391. Maryland Department of Natural Resources. 1990. Anadromous fish stream survey program, 1969-71. Unpublished data. Maryland Dept. Natural Resources, Annapolis, MD.

392. Maryland Department of Natural Resources. 1990. Potomac River Fisheries Program, 1974-1976. Unpublished data. Maryland Dept. Natural Resources, Annapolis, MD.

393. Maryland Department of Natural Resources. 1992. Coastal bay finfish stock investigations: Trawl survey, 1972-1988. Unpublished data. Maryland Dept. Natural Resources, Annapolis, MD.

394. Massman, W.H. 1952. A preliminary study of shad, *Alosa sapidissima*, spawning in some Virginia rivers. M.A. thesis, Virginia Inst. Marine Science, Coll. William and Mary, Gloucester Pt., VA. 24 p.

395. Massman, W.H. 1963. Age and size composition of weakfish, *Cynoscion regalis*, from pound nets in Chesapeake Bay, Virginia, 1954-1958. Chesapeake Sci. 4(1): 43-51.

396. Massman, W.H., E.C. Ladd, and H.N. McCutcheon. 1952. A biological survey of the Rappahannock River, Virginia. Va. Fish. Lab., Spec. Sci. Rep. 6, 221 p.

397. Massman, W.H., E.C. Ladd, and H.N. McCutcheon. 1954. Postlarvae and young of the menhaden (*Brevoortia tyrannus*) in brackish and fresh waters of Virginia. Copeia 1954: 19-23.

398. Massman, W.H., J.J. Norcross, and E.B. Joseph. 1963. Distribution of larvae of the naked goby, *Gobiosoma bosci*, in the York River. Chesapeake Sci. 4(3): 120-125.

399. Massman, W.H., J.P. Whitcomb, and A.L. Pacheco. 1958. Distribution and abundance of gray weakfish in the York River system, Virginia. Trans. No. Am. Wildl. Conf. 23: 361-369.

400. Mattson, D.J., and M.T. Dunning. 1990. Abundance and stock characteristics of the Atlantic tomcod (*Microgadus tomcod*) spawning population in the Hudson River, winter 1988-89. Normandeau Associates, Inc., Bedford, N.H. Prepared for New York Power Authority, White Plains, NY. 83 p.

401. Maurer, D., L. Watling, and G. Aprill. 1974. The distribution and ecology of common marine and estuarine pelecypods in the Delaware Bay area. The Nautilus 88(2): 38-45.

402. Mayo, H.J., and R.M. Lewis. 1983. Distribution of eggs and larvae of Atlantic menhaden, *Brevoortia tyrannus*, along the Atlantic coast of the United States. NOAA Tech. Rep. NMFS SSRF-774. 23 p.

403. McCambridge, J.T., Jr., and R.W. Alden, III. 1984. Growth of juvenile spot, *Leiostomus xanthurus*, in the nursery region of the James River, Virginia. Estuaries 7(4B): 478-486.

404. McCarthy, K.J. 1989. The influence of salinity on the swimming behavior of larval *Crassostrea virginica* (Gmelin). M.A. thesis, Virginia Inst. Marine Science, Coll. William and Mary, Gloucester Pt., VA.

405. McClain, J.F. 1973. Phase I: Fish studies. *In* Studies of the Upper Barnegat system. N.J. Dept. Environmental Protection. Misc. Rep. No. 10M.

406. McClain, J.F. 1973. Studies of Great Egg Harbor River and Bay: Final report for Project 3-137-R-1. N.J. Dept. Environmental Protection, Div. Fish, Game and Shellfisheries. Misc. Rep. No. 8M.

407. McCloy, T.W. 1977. Evaluation of the New Jersey Atlantic Coast hard clam relay program: Final report for project 3-191-R funded in part by the Commercial Fisheries Research and Development Act. N.J. Dept. Environmental Protection, Div. Fish, Game, and Shellfisheries, Nacote Creek Shellfish Office. Misc. Rep. No. SF-1.1.

408. McCloy, T.W. 1979. Assessment of the hard clam resource supporting the 1978 relay program. N.J. Dept. Environmental Protection, Div. Fish, Game, and Shellfisheries, Nacote Creek Shellfish Office. Misc. Rep. No. SF-3.

409. McCracken, F.D. 1963. Seasonal movements of the winter flounder, *Pseudopleuronectes americanus* (Walbaum), on the Atlantic Coast. J. Fish. Res. Bd. Canada 20: 551-586.

410. McCutcheon, H.N. 1953. Differential growth of the menhaden, *B. tyrannus*, during early development. M.A. thesis, Virginia Inst. Marine Science, Coll. William and Mary, Gloucester Pt., VA. 40 p.

411. McDermott, V. 1970. Study of the ichthyoplankton associated with two of New Jersey's coastal inlets. N.J. Dept. Environmental Protection, Div. Fish, Game, and Shellfisheries. Misc. Report No. 7M.

412. McEachran, J.D. 1968. Age and growth of the striped searobin. M.A. thesis, Virginia Inst. Marine Science, Coll. William and Mary, Gloucester Pt., VA. 48 p.

413. McEachran, J.D. 1973. Biology of seven species of skates (Pisces: Rajidae). Ph.D. dissertation, Virginia Inst. Marine Science, Coll. William and Mary, Gloucester Pt., VA. 127 p.

414. McEachran, J.D., and J.A. Musick. 1975. Distribution and relative abundance of seven species of skates. Fish. Bull., U.S. 73(1): 110-136.

415. McGovern, J.C. 1991. Factor affecting survival of early life stages of striped bass. Ph.D. dissertation, Virginia Inst. Marine Science, Coll. William and Mary, Gloucester Pt., VA.

416. McHugh, J.L. 1981. Marine fisheries of Delaware. Fish. Bull., U.S. 79(4): 575-599.

417. McHugh, J.L. 1984. Long Island Sound Fisheries: Past, Present, and Future. Contrib. No. 541. State Univ. New York, Marine Sciences Research Center, Stony Brook, NY.

418. McHugh, J.L., R.T. Oglesby, and A.L. Pacheco. 1959. Length, weight, and age composition of the menhaden catch in Virginia waters. Limnol. Oceanogr. 4(2): 145-162.

419. McKown, K., and B. Young. 1991. Beach seine surveys of Bell Port Bay, 1986-1990. Unpublished data. N.Y. State Dept. Environmental Conservation, Marine Finfish Project. State Univ. New York, Stony Brook, NY.

420. McKown, K., and B. Young. 1991. Beach seine surveys of Gardiners Bay, 1988. N.Y. State Dept. Environmental Conservation, Marine Finfish Project. State Univ. New York. Stony Brook, NY.

421. McKown, K., and B. Young. 1991. Beach seine surveys of Great South Bay, 1988. Unpublished data. N.Y. State Dept. Environmental Conservation, Marine Finfish Project. State Univ. New York, Stony Brook, NY.

422. McKown, K., and B. Young. 1991. Beach seine surveys of Hemstead Harbor, 1986-1990. Unpublished data. N.Y. State Dept. Environmental Conservation, Marine Finfish Project. State Univ. New York, Stony Brook, NY.

423. McKown, K., and B. Young. 1991. Beach seine surveys of Hudson River, 1985-1990. N.Y. State Dept. Environmental Conservation, Marine Finfish Project. State Univ. New York, Stony Brook, NY.

424. McKown, K., and B. Young. 1991. Beach seine surveys of Jamaica Bay, 1986-1990. N.Y. State Dept. Environmental Conservation, Marine Finfish Project. State Univ. New York, Stony Brook, NY.

425. McKown, K., and B. Young. 1991. Beach seine surveys of Little Neck Bay, 1986-1990. Unpublished data. N.Y. State Dept. Environmental Conservation, Marine Finfish Project. State Univ. New York, Stony Brook, NY.

426. McKown, K., and B. Young. 1991. Beach seine surveys of Manhassett Bay, 1986-1990. Unpublished data. N.Y. State Dept. Environmental Conservation, Marine Finfish Project. State Univ. New York, Stony Brook, NY.

427. McKown, K., and B. Young. 1991. Beach seine surveys of Peconic Bay, 1986-1989. N.Y. State Dept. Environmental Conservation, Marine Finfish Project. State Univ. New York, Stony Brook, NY.

428. McKown, K., and B. Young. 1991. Beach seine surveys of Port Jefferson, 1987. Unpublished data. N.Y. State Dept. Environmental Conservation, Marine Finfish Project. State Univ. New York, Stony Brook, NY.

429. McKown, K., and B. Young. 1991. Beach seine surveys of South Oyster Bay, 1986-1989. Unpublished data. N.Y. State Dept. Environmental Conservation, Marine Finfish Project. State Univ. New York, Stony Brook, NY.

430. McKown, K., and B. Young. 1991. Beach seine surveys of Staten Island, 1986-1989. Unpublished data. N.Y. State Dept. Environmental Conservation, Marine Finfish Project. State Univ. New York, Stony Brook, NY.

431. McKown, K., and B. Young. 1991. Beach seine surveys of Stony Brook Harbor, 1987-1989. Unpublished data. N.Y. State Dept. Environmental Conservation, Marine Finfish Project. State Univ. New York, Stony Brook, NY.

432. McLeese, D.W. 1954. Effects of temperature, salinity, and oxygen on the survival and distribution of the lobster, *Homarus americanus*, Milne-Edwards. Ph.D. dissertation, Univ. Toronto., Toronto, Ontario, Canada.

433. Menzel, R.W. 1943. Notes on the biology and commercial fishery of the catfish of the James River, Virginia. M.A. thesis, Virginia Inst. Marine Science, Coll. William and Mary, Gloucester Pt., VA. 51 p.

434. Mercer, L.P. 1973. The comparative ecology of two species of pipefish (Syngnathidae) in the York River, Virginia. M.A. thesis, Virginia Inst. Marine Science, Coll. William and Mary, Gloucester Pt., VA. 37 p.

435. Mercer, L.P. 1989. Species profiles: life histories and environmental requirements of coastal fishes and invertebrates (Mid-Atlantic) - weakfish. U.S. Fish Wildl. Serv. Biol. Rep. 82(11.109). U.S. Army Corps of Engineers, TR EL-82-4. 17 p.

436. Mercer, L.P. 1989. Species profiles: life histories and environmental requirements of coastal fishes and invertebrates (South Atlantic) - black sea bass. U.S. Fish Wildl. Serv. Biol. Rep. 82(11.99). U.S. Army Corps of Engineers, TR EL-82-4. 16 p.

437. Mercille, B. and J. Dagenais. 1987. A literature review of the biology and exploitation of the American sand lance (*Ammodytes americanus*). Rapp. Manuscr. Can. Sci. Halieut. Aquat., No. 1927. 55 p.

438. Merriman, D., and R.C. Sclar. 1952. The pelagic fish eggs and larvae of Block Island Sound. Bull. Bingham Oceanogr. Coll. 13(3): 165-218.

439. Merriman, D., and L.M. Thorpe (eds.). 1976. The Connecticut River Ecological Study. American Fisheries Society Monograph 1. American Fisheries Society, Bethesda, MD. 252 p.

440. Merriner, J.V. 1976. Aspects of the reproductive biology of the weakfish, *Cynoscion regalis* (Sciaenidae) in North Carolina. Fish. Bull., U.S. 74(1): 18-26.

441. Merriner, J.V., and N.J. Brown. 1980. Reproductive biology and sport fishery of spotted seatrout (*Cynoscion nebulosus*) in the Chesapeake Bay area. Grant Report QL638S34M4. Virginia Inst. Marine Science, Gloucester Pt., VA.

442. Metcalf, K.S. 1991. The relationship of of habitat and spatial scale upon the developmental state and settlement of blue crab postlarvae in Chesapeake Bay. M.A. thesis, Virginia Inst. Marine Science, Coll. William and Mary, Gloucester Pt., VA.

443. Michelman, M.S. 1988. The biology of juvenile scup (*Stenotomus chrysops*) in Narragansett Bay, Rhode Island: Food habits, metabolic rate, and growth rate. M.S. thesis, Univ. Rhode Island, Kingston, RI. 103 p.

444. Michels, S.F., and R.J. Seagraves. 1991. Stream and Inland Bays fish survey. II. Monitoring fish populations in Delaware's estuaries. Delaware Dept. of Natural Resources and Environmental Control. Final Report, Delaware Proj. No. F-37-R-5. 231 p.

445. Middleton, R.W. 1986. The seasonal and diel use by juvenile and adult finfishes of a mesohaline intertidal creek on the York River, Virginia. Ph.D. dissertation, Virginia Inst. Marine Science, Coll. William and Mary, Gloucester Pt., VA.

446. Mihursky, J.A., W.R. Boynton, E.M. Setzler, K.V. Wood, H.H. Zion, E.W. Gordon, P. Pulles, and J. Leo. 1976. Potomac estuary fisheries study: Ichthyoplankton and juvenile investigations, final report. Submitted to Power Plant Siting Program, Md. Dept. of Natural Resources, by Univ. of Md., Center for Environmental and Estuarine Studies, Chesapeake Biological Lab., Solomons, MD. CEES Ref. No. 76-12 CBL.

447. Miller, R.W. 1982. An overview of the status of river herring (*Alosa aestivalis* and *Alosa pseudoharengus*) in Delaware. Delaware Dept. Natural Resources and Environmental Control, Div. Fish and Wildlife.

448. Milstein, C.B., G.J. Miller, and E.V. Garlo. 1981. Decapod crustaceans new or rare to New Jersey waters. Bull. N.J. Acad. Sci. 26(1), 30-31.

449. Milstein, C.B., and D.L. Thomas. 1976. Fishes new or uncommon to the New Jersey coast. Chesapeake Sci. 17(3): 198-204.

450. Milstein, C.B., D.L. Thomas, and Associates. 1977. Summary of ecological studies for 1972-1975 in the bays and other waterways near Little Egg Inlet and in the vicinity of the proposed site for the Atlantic generating station, New Jersey. Ichthyological Associates, Inc.

451. Modlin, R.F. 1980. The life cycle and recruitment of the sand shrimp, *Crangon septimspinosa*, in the Mystic River estuary, Connecticut. Estuaries 3(1): 1-10.

452. Monteleone, D.M. 1988. Trophic Interactions of Ichthyoplankton in Great South Bay, New York. Ph.D. dissertation, State Univ. New York, Stony Brook, NY. 272 p.

453. Monteleone, D.M. 1992. Seasonality and abundance of ichthyoplankton in Great South Bay, New York. Estuaries 15(2): 230-238.

454. Monteleone, D.M., R.M. Cerrato, D.J. Lonsdale, and W.T. Peterson. 1990. Characterization and Assessment of Potential Impacts of Hypoxia on Forage Species in Long Island Sound, Task 1 - Abundance and Seasonality of Key Resource Species and Their Forage Species. State Univ. New York, Marine Sciences Research Center, Stony Brook, NY. 107 p.

455. Morales-Alamo, R., C. Cox, K. McCarthy, and R. Mann. 1988. Seasonal abundance of oyster spat and four animal associates on an oyster reef in the James River, Virginia. J. Shellfish Res. 7(3): 401-406.

456. Morin, R.P., and M.F. Hirshfield. 1984. Thermal effects on the life history of the mummichog: *Fundulus heteroclitus*. Proc. Acad. Nat. Sci. Phila. 136: 218-228.

457. Morse, W.W. 1978. Biological and fisheries data on scup, *Stenotomus chrysops* (Linnaeus). NOAA/ NMFS-NEFC Tech. Ser. Rep. No. 12. 41 p.

458. Morse, W.W. 1980. Spawning and fecundity of Atlantic mackerel, *Scomber scombrus*, in the Mid-Atlantic Bight. Fish. Bull., U.S. 78(1): 103-108.

459. Morton, T. 1989. Species profiles: life histories and environmental requirements of coastal fishes and invertebrates (Mid-Atlantic) - bay anchovy. U.S. Fish Wildl. Serv. Biol. Rep. 82(11.97). U.S. Army Corps of Engineers, TR EL-82-4. 13 p.

460. Moss, D.D. 1960. A History of the Connecticut River and Its Fisheries. Connecticut Board of Fisheries and Game. 15 p.

461. Moss, S.A., W.C. Leggett, and W.A. Boyd. 1976. Recurrent mass mortalities of the blueback herring, *Alosa aestivalis*, in the lower Connecticut River. *In* Merriman, D., and L.M. Thorpe (eds.), pp. 227-234. The Connecticut River Ecological Study. American Fisheries Society Monograph 1. American Fisheries Society, Bethesda, MD. 252 p.

462. Mowrer, J.P. 1978. The occurrence and abundance of the American eel in freshwater streams of Maryland. Vol. III, Final Report, March 1974 - October 1976 for upper Chesapeake Bay drainage and Potomac River Drainage. Maryland Dept. Natural Resources, Fisheries Admin., Anadromous Fish Stream Survey Program. 92 p.

463. Mowrer, J.P., C.A. Krantz, T.A. Jarzynski, M.H. Howell, and D.R. Weinrich. 1990. Investigation of Anadromous Alosids in Chesapeake Bay. Completion Report F-37-R. U.S. Fish and Wildlife Service. 84 p.

464. Mullen, D.M., C.W. Fay, and J.R. Moring. 1986. Species profiles: life histories and environmental requirements of coastal fishes and invertebrates (North Atlantic) - alewife and blueback herring. U.S. Fish Wildl. Serv. Biol. Rep. 82(11.56). U.S. Army Corps of Engineers, TR EL-82-4.

465. Muncy, R.J. 1984. Species profiles: life histories and environmental requirements of coastal fishes and invertebrates (Gulf of Mexico) - pinfish. U.S. Fish Wildl. Serv. Biol. Rep. 82(11.26). U.S. Army Corps of Engineers, TR EL-82-4. 18 p.

466. Murawski, S.A., D.G. Frank, and S. Chang. 1978. Biological and fisheries data on butterfish, *Peprilus triacanthus* (Peck). NOAA/NMFS Sandy Hook Lab., Tech. Ser. Rep. No. 6. 39 p.

467. Musick, J.A. 1972. Fishes of Chesapeake Bay and the adjacent coastal plain. *In* Wass, M.L. (ed.), p. 175-212. A check list of the biota of lower Chesapeake Bay. Virginia Inst. Marine Science, Gloucester Pt., VA. Spec. Sci. Rep. No. 65.

468. Musick, J.A. 1974. Seasonal distribution of hakes in New England. Fish. Bull., U.S. 72: 481-495.

469. Musick, J.A., and L.P. Mercer. 1977. Seasonal distribution of black sea bass, *Centropristis striata*, in the Mid-Atlantic bight with comments on the ecology and fisheries of the species. Trans. Am. Fish. Soc. 106(1): 12-25.

470. Natural Resources Institute and University of Maryland. 1970. Final Report: Assateague Ecological Studies, Part 1: Environmental Information. Natural Resources Inst. and Univ. Maryland. Contrib. No. 446. 426 p.

471. Nelson, D.A., J.E. Miller, D. Rusanowsky, R.A. Greig, G.R. Sennefelder, R. Mercaldo-Allen, C. Kuropat, E. Gould, F.P. Thurberg, and A. Calabrese. 1991. Comparative reproductive success of winter flounder in Long Island Sound: a three-year study (biology, biochemstry, and chemistry). Estuaries 14: 318-331.

472. Newell, C.R., and H. Hidu. 1986. Species profiles: life histories and environmental requirements of coastal fishes and invertebrates (North Atlantic) - softshell clam. U.S. Fish Wildl. Serv. Biol. Rep. 82(11.53). U.S. Army Corps of Engineers, TR EL-82-4.

473. Newell, R.C. 1979. Biology of Intertidal Animals. Marine Ecological Surveys, Ltd. Faversham, U.K., 781 pp.

474. Newell, R.I.E. 1989. Species profiles: life histories and environmental requirements of coastal fishes and invertebrates (North and Mid-Atlantic Bight) - blue mussel. U.S. Fish Wildl. Serv. Biol. Rep. 82(11.102). U.S. Army Corps of Engineers, TR EL-82-4. 25 p.

475. Newell, R.I.E., T.J. Hilbish, R.K. Koehn, and C.J. Newell. 1982. Temporal variation in the reproductive cycle of *Mytilis edulis* from localities on the east coast of the United States. Biol. Bull. (Woods Hole) 162: 299-310.

476. Newell, R.I.E., T.J. Jones, V.S. Kennedy, and S. Alspach. 1989. Factors regulating reproduction and recruitment in populations of the American oyster *Crassostrea virginica*. J. Shellfish Res. 8(2): 434.

477. Nizinski, M.S., B.B. Collette, and B.B. Washington. 1990. Separation of two species of sand lances, *Ammodytes americanus* and *A. dubius*, in the western North Atlantic. Fish. Bull., U.S. 88(2): 241-255.

478. NOAA. 1976. Current fisheries statistics, Maryland and Virginia landings, annual summaries, 1960-1976. U.S. Dept. of Commerce, NOAA/NMFS, Washington, DC.

479. NOAA. 1989. Waquoit Bay National Estuarine Research Reserve: Management Plan. NOAA/NOS Office of Ocean and Coastal Resource Management, Washington, D.C. 122 p.

480. Norcross, B.L. 1983. Climate scale environmental factors affecting year-class fluctuations of Atlantic croaker (*Micropogonias undulatus*) in the Chesapeake Bay. Ph.D. dissertation, Virginia Inst. Marine Science, Coll. William and Mary, Gloucester Pt., VA.

481. Norcross, B.L. 1988. Transport and recruitment of spot (*Leiostomus xanthurus*) into the Chesapeake Bay. Intl. Coun. Expl. Sea, Early Life History Symposium, Paper 82.

482. Norcross, B.L. 1991. Estuarine recruitment mechanisms of larval Atlantic croaker. Trans. Am. Fish. Soc. 120(6): 673-683.

483. Norcross, B.L., and H.M. Austin. 1981. Climate scale environmental factors affecting year class fluctuations of Chesapeake Bay croaker, *Micropogonias undulatus*. Spec. Sci. Rep. VIMS-SSR-110. Virginia Inst. Marine Science, Gloucester Pt., VA. 84 p.

484. Norcross, B.L., and H.M. Austin. 1988. Middle Atlantic Bight meridonal wind component effect on bottom water temperatures and spawning distribution of Atlantic croaker. Continental Shelf Res. 8(1): 69-88.

485. Norcross, B.L., and D. Hata. 1990. Seasonal composition of finfish in waters behind the Virginia Barrier Islands. Va. J. Sci. 41(4A):441-461.

486. Norcross, J.J., S.L. Richardson, W.H. Massman, and E.B. Joseph. 1974. Development of young bluefish (*Pomatomus saltatrix*) and distribution of eggs and young in Virginian coastal waters. Trans. Am. Fish. Soc. 103(3): 477-497.

487. Nyman, R.M., and D.O. Conover. 1988. The relationship between spawning season and the recruitment of young-of-the year bluefish, *Pomatomus saltatrix*, to New York. Fish. Bull., U.S. 86: 237-250.

488. O'Brien, K.M., L.A. Deegan, J.T. Finn, and S.G. Ayvazian. 1990. The effects of macroalgae on the abundance and diversity of free-swimming invertebrates in eelgrass beds of Waquoit Bay, Massachusetts. Biol. Bull. (Woods Hole) 179: 223 (abstract).

489. O'Dell, J. 1981. Segment report project AFC-10-1. Maryland Dept. Natural Resources, Annapolis, MD.

490. O'Dell, J. 1982. Segment report project AFC-10-2. Maryland Dept. Natural Resources, Annapolis, MD.

491. O'Dell, J. 1987. Status of yellow perch in Maryland. Md. Dept. Nat. Res., Tidewater Admin., Annapolis, MD.

492. O'Dell, J., H.J. King, and J.P. Gabor. 1973. Survey of anadromous fish spawning areas. Submitted to NOAA/NMFS by Md. DNR Fisheries Admin., Annapolis, MD. 65 p.

493. O'Dell, J., R.C. Dintaman, and J. Gabor. 1976. Fishes of the Potomac estuary. *In* Mason, W.T., and K.C. Flynn (eds.), p. 100-104. The Potomac Estuary: Biological Resources, Trends, and Options. Proceedings of a symposium sponsored by Interstate Commission on the Potomac River Basin and Power Plant Siting Program, Maryland Dept. Nat. Res. ICPRB Tech. Pub. 76-2, Bethesda, MD.

494. O'Herron, J.C., Jr., K.W. Able, and R.W. Hastings. 1993. Movements of shortnose sturgeon (*Acipenser brevirostrum*) in the Delaware River. Estuaries 16(2): 235-240.

495. O'Neill, S.P., and M.P. Weinstein. 1987. Feeding habitats of spot, *Leiostomus xanthurus*, in polyhaline versus meso-oligohaline tidal creeks and shoals. Fish. Bull., U.S. 85(4): 785-796.

496. Oglesby, R.T. 1955. Age and length of menhaden (*Brevoortia tyrannus*) in the waters in Chesapeake Bay, with comments of the rate of growth. M.A. thesis, Virginia Inst. Marine Science, College of William and Mary, Gloucester Pt., VA. 27 p.

497. Oliver, J.D., M.J. Van Den Avyle, and E.L. Bozeman, Jr. 1989. Species profiles: life histories and environmental requirements of coastal fishes and invertebrates (South Atlantic) - bluefish. U.S. Fish Wildl. Serv. Biol. Rep. 82 (11.96). U.S. Army Corps of Engineers, TR EL-82-4. 13 p.

498. Olla, B.L., A.J. Bejda, and A.D. Martin. 1974. Daily activity, movement, feeding, and seasonal occurence of the tautog, *Tautoga onitis*. Fish Bull., U.S. 72(1): 27-35.

499. Olla, B.L., C. Samet, and A.L. Studholme. 1981. Correlates between number of mates, shelter availability and reproductive behavior in the tautog, *Tautoga onitis*. Mar. Biol. 62(4): 239-248.

500. Olla, B.L., A.L. Studholme, A.J. Bejda, and C. Samet. 1980. Role of temperature in triggering migratory behavior of the adult tautog, *Tautoga onitis*, under laboratory conditions. Mar. Biol. 59(1): 23-30.

501. Olney, J.E. 1983. Eggs and early larvae of the bay anchovy, *Anchoa mitchilli*, and the weakfish, *Cynoscion regalis*, in Lower Chesapeake Bay, with notes on associated icthyoplankton. Estuaries 6(1): 20-35.

502. Olney, J.E, and G.W. Boehlert. 1988. Nearshore ichthyoplankton associated with seagrass beds in the Lower Chesapeake Bay. Mar. Ecol. Prog. Ser. 45(1-2): 33-43.

503. Olney, J.E., J.D. Field, and J.C. McGovern. 1991. Striped bass egg mortality, production, and female biomass in Virginia rivers, 1980-1989. Trans. Am. Fish. Soc. 120(3): 354-367.

504. Olsen, S., D.D. Robadue, and V. Lee. 1984. An interpretive atlas of Narragansett Bay. Univ. Rhode Island, Coastal Resources Center, Narragansett, RI. 82 p.

505. Olsen, S.B., and D.K. Stevenson. 1975. Commercial Marine Fish and Fisheries of Rhode Island. Univ. Rhode Island, Coastal Resources Center, Narragansett, RI. Marine Tech. Rep. 34. 117 p.

506. Otwell, W.S. 1973. Optimum age, temperature and salinity for estuarine stocking of juvenile striped bass, *Morone saxatilis*. M.A. thesis, Virginia Inst. Marine Science, Coll. William and Mary, Gloucester Pt., VA. 48 p.

507. Overcash, A.E. 1946. The use of measurement to determine the condition of oysters in Virginia. M.A. thesis, Virginia Inst. Marine Science, Coll. William and Mary, Gloucester Pt., VA. 42 p.

508. Overholtz, W.J., R.S. Armstrong, D.G. Mountain, and M. Tercerio. 1991. Factors influencing spring distribution, availability, and recreational catch of Atlantic Mackerel (*Scomber scombrus*) in the middle Atlantic and southern New England regions. NOAA Tech. Memo. NMFS-F/NEC-85. 13 p.

509. Oviatt, C.A., and S.W. Nixon. 1973. The demersal fish of Narragansett Bay: an analysis of community structure, distribution and abundance. Estuarine Coastal Mar. Sci. 1: 361-378.

510. Owen, R.D., R.L. Bedenbaugh, and R.S. Birdsong. 1984. Seasonality and abundance of demersal fishes in an industrialized estuary. Va. J. Sci. 35(2): 115.

511. Pacheco, A.L. 1957. Length composition of croaker, spot, and gray trout in the pound net catches of the lower York River, 1956. VIMS Progress Report No. 38. Virginia Inst. Marine Science, Coll. William and Mary, Gloucester Pt., VA.

512. Pacheco, A.L. 1957. The length and age composition of spot, *Leiostomus xanthurus*, in the pound net fishery of lower Chesapeake Bay. M.A. thesis, Virginia Inst. Marine Science, Coll. William and Mary, Gloucester Pt., VA. 34 p.

513. Pacheco, A.L. 1962. Age and growth of spot in lower Chesapeake Bay, with notes on distribution and abundance of juveniles in the York River system. Chesapeake Sci. 3(1): 18-28.

514. Pacheco, A.L. (ed.) 1968. Proceedings of a workshop on egg, larval, and juvenile stages of fish in Atlantic coast estuaries. Atlantic States Marine Fisheries Commission and U.S. Fish and Wildlife Service. Bears Bluff Laboratories, Wadmalaw Island, SC.

515. Pacheco, A.L. (ed.). 1973. Proceedings of a workshop on egg, larval, and juvenile stages of fish in Atlantic Coast estuaries. NOAA/NMFS Middle Atlantic Coastal Fisheries Center, Tech. Pub. No.1. 338 p.

516. Pacheco, A.L., and G.C. Grant. 1965. Studies of the early life history of Atlantic menhaden in estuarine nurseries. Part 1: Seasonal occurrence of juvenile menhaden and other small fishes in a tributary creek of Indian River, Delaware, 1957-58. Spec. Sci. Rep., Fisheries No. 504. U.S. Fish Wildl. Serv., Washington, DC.

517. Parsons, D.G., and G.E. Tucker. 1986. Fecundity of northern shrimp, *Pandalis borealis* (crustacea, decapoda), in areas of the northwest Atlantic. Fish. Bull., U.S. 84: 549-558.

518. Peebles, J.B. 1979. Principal spawning areas and times of marine fishes, Cape Sable to Cape Hatteras. Fish. Bull., U.S. 76(4): 911-914.

519. Pellegrino, P.E., and W.A. Hubbard. 1983. Baseline Shellfish Data for the Assessment of Potential Environmental Impacts Associated with Energy Activities in Connecticut's Coastal Zone. Connecticut Dept. Agriculture, Hartford, CT. 177 p.

520. Penry, D.L. 1982. Utilization of a *Zostera marina* and *Ruppia maritima* habitat by four decapods with emphasis on *Callinectes sapidus*. M.A. thesis, Virginia Inst. Marine Science, Coll. William and Mary, Gloucester Pt., VA. 101 p.

521. Perlmutter, A. 1947. The blackback flounder and its fishery in New England and New York. Bull. Bingham Oceanogr. Coll. 9: 1-92.

522. Perlmutter, A., E.E. Schmidt, and E. Leff. 1967. Distribution and abundance of fish along the shores of the lower Hudson River during the summer of 1965. N.Y. Fish Game J. 14(1): 47-75.

523. Perra, P. 1985. Interstate fisheries management planning for Chesapeake Bay. *In* Chase, V.C. (ed.). The Chesapeake: Prologue to the Future. Proceedings from the Chesapeake Bay Symposium, pp. 67-69. National Marine Educators Conference, July 30 - August 3, 1985.

524. Perry, D.M., J.B. Hughes, and A.T. Hebert. 1991. Sublethal abnormalities in embryos of winter flounder, *Pseudopleuronectes americanus*, from Long Island Sound. Estuaries 14(3): 306-317.

525. Perry, H.M., and T.D. McIlwain. 1986. Species profiles: life histories and environmental requirements of coastal fishes and invertebrates (Gulf of Mexico) - blue crab. U.S. Fish Wildl. Serv. Biol. Rep. 82(11.55). U.S. Army Corps of Engineers, TR EL-82-4. 21 p.

526. Pfitzenmeyer, H.T. 1962. Periods of spawning and setting of the soft-shelled clam, *Mya arenaria*, at Solomons, Maryland. Chesapeake Sci. 3(2): 114-120.

527. Pfitzenmeyer, H.T. 1965. Annual cycle of gametogenesis of the soft-shelled clam, *Mya arenaria*, at Solomons, Maryland. Chesapeake Sci. 6: 52-59.

528. Pfitzenmeyer, H.T. 1974. The effects of Morgantown steam electric station operations on organisms pumped through the cooling water system, Part IV: Benthic investigations. Prepared for Power Plant Siting Program, Md. Dept. Nat. Res., by Univ. of Md., Natural Resources Institute, Chesapeake Biological Laboratory, Solomons, MD. Ref. No. 74-13.

529. Pfitzenmeyer, H.T., and K.G. Drobeck. 1963. Benthic survey for populations of soft-shelled clams, *Mya arenaria*, in the lower Potomac River, Maryland. Chesapeake Sci. 5(4): 209-212.

530. Pfitzenmeyer, H.T., and K.G. Drobeck. 1967. Some factors influencing reburrowing activity of soft-shell clam, *Mya arenaria*. Chesapeake Sci. 8: 193-199.

531. Phelan, B.A. 1992. Winter flounder movements in the inner New York bight. Trans. Am. Fish. Soc. 121(6): 777-784.

532. Phillips, F.X. 1972. The ecology of the benthic macroinvertebrates of Barnegat Bay, New Jersey. Ph.D. dissertation, Rutgers Univ., New Brunswick, NJ.

533. Phillips, J.M., M.T. Huish, J.H. Kerby, and D.P. Moran. 1989. Species profiles: life histories and environmental requirements of coastal fishes and invertebrates (Mid-Atlantic) - spot. U.S. Fish Wildl. Serv. Biol. Rep. 82(11.98). U.S. Army Corps of Engineers, TR EL-82-4. 13 p.

534. Phillips, R.R., and S.B. Swears. 1981. Diel cycles of two Chesapeake Bay fishes, the striped blenny (*Chasmodes bosquianus*) and the oyster toadfish (*Opsanus tau*). Estuaries 4(4): 357-362.

535. Pierce, D.E., and A.B. Howe. 1977. A further study on winter flounder group identification off Massachusetts. Trans. Am. Fish. Soc. 106: 131-139.

536. Poole, J.C. 1969. A study of winter flounder mortality rates in Great South Bay, New York. Trans. Am. Fish. Soc. 98(4): 611-616.

537. Pottern, G.B., M.T. Huish, and J.H. Kerby. 1989. Species profiles: life histories and environmental requirements of coastal fishes and invertebrates (Mid-Atlantic) - bluefish. U.S. Fish Wildl. Serv. Biol. Rep. 82 (11.94). U.S. Army Corps of Engineers, TR EL-82-4. 20 pp.

538. Powell, J.C. 1988. Juvenile finfish survey 1988. Rhode Island Div. Fish and Wildlife. Performance Report, Project No. F-26-R-23. 66 p.

539. Powell, J.C. 1989. Juvenile finfish survey 1989. Rhode Island Div. Fish and Wildlife. Performance Report, Project No. F-26-R-24. 47 p.

540. Powell, J.C. 1990. Juvenile finfish survey 1990. Rhode Island Div. Fish and Wildlife. Performance Report, Project No. F-26-R-25. 54 p.

541. Powell, J.C. 1991. Juvenile finfish survey 1991. Rhode Island Div. Fish and Wildlife. Performance Report, Project No. F-26-R-26. 30 p.

542. Prager, M.H., J.R. McConaugha, C.M. Jones, and P.J. Geer. 1990. Fecundity of blue crab, *Callinectes sapidus*, in Chesapeake Bay: Biological, statistical and management considerations. Bull. Mar. Sci. 46(1): 170-179.

543. Pratt, S.D., A.R. Ganz, and M.A. Rice. 1992. A profile of the quahog in Rhode Island. Draft manuscript. Rhode Island Sea Grant Program, Narragansett, RI. 117 p.

544. Pratt, S.D., B.K. Martin, and S.B. Saila. 1988. Status of the hard clam in the Providence River and Mount Hope Bay. Univ. Rhode Island, Graduate School of Oceanography, Narragansett, RI. Prepared for U.S. EPA Region 1, Water Management Div. 35 p.

545. Price, K.S., Jr. 1961 Biology of the sand shrimp, *Crangon septemspinosa*, in the shore zone of the Delaware Bay region. M.S. thesis, Univ. Delaware, Newark, DE.

546. Price, K.S., Jr. 1962. Biology of the sand shrimp, *Crangon septimspinosa*, in the shore zone of the Delaware bay region. Chesapeake Sci. 3:244-255.

547. Price, K.S., Jr. 1967. Copulatory behavior in the clearnose skate, *Raja eglanteria*, in Lower Chesapeake Bay. Copeia 1967(4): 854-855.

548. Provenzano, A.J., Jr., K.B. Schmitz, and M.A. Boston. 1978. Survival, duration of larval stages and size of postlarvae of grass shrimp, *Palaemonetes pugio*, reared from Kepone® contaminated and uncontaminated populations in Chesapeake Bay. Estuaries 1(4): 239-244.

549. Purcell, J.E., F.P. Cresswell, D.G. Cargo, and V.S. Kennedy. 1991. Differential ingestion and digestion of bivalve larvae by the scyphozoan *Chrysaora quinquecirrha* and the cteniphore *Mnemiopsis leidyi*. Biol. Bull. (Woods Hole) 180(1): 103-111.

550. Raasch, M.S., and V.L.S. Altemus. 1991. Delaware's Freshwater and Brackish Water Fishes. Delaware State College, and Society of Natural History of Delaware, Dover, DE. 166 p.

551. Rainer, J.S., and R. Mann. 1989. Estimation of oyster standing stock using SCUBA. J. Shellfish Res. 8(2): 487.

552. Reagan, R.E. 1985. Species profiles: life histories and environmental requirements of coastal fishes and invertebrates (Gulf of Mexico) - red drum. U.S. Fish Wildl. Serv. Biol. Rep. 82(11.36). U.S. Army Corps of Engineers, TR EL-82-4.

553. Reisman, H.H., and W. Nicol. 1973. The fishes of Gardiner's Island, New York. N.Y. Fish Game J. 20: 25-31.

554. Richards, C.E., and M. Castagna. 1970. Marine fishes of Virginia's Eastern Shore (inlet and marsh, seaside waters). Chesapeake Sci. 11(4): 235-248.

555. Richards, S.W. 1959. Pelagic fish eggs and larvae of Long Island Sound. Bull. Bingham Oceanogr. Coll. 17: 95-124.

556. Richards, S.W. 1963. The demersal fish population of Long Island Sound: food of the juveniles from a mud locality (station 3a). Bull. Bingham Oceanogr. Coll. 18: 73-92.

557. Richards, S.W. 1963. The demersal fish population of Long Island Sound: food of the juveniles from a sand-shell locality (station 1). Bull. Bingham Oceanogr. Coll. 18: 31-71.

558. Richards, S.W. 1963. The demersal fish population of Long Island Sound: species composition and relative abundance in two localities, 1956-57. Bull. Bingham Oceanogr. Coll. 18: 5-30.

559. Richards, S.W. 1976. Age, growth, and food of bluefish (*Pomatomus salatrix*) from east-central Long Island Sound from July through November 1975. Trans. Am. Fish. Soc. 4: 523-525.

560. Richards, S.W. 1982. Aspects of the biology of *Ammodytes* from the St. Lawrence River to Chesapeake Bay, 1972-75, including a comparison of the Long Island Sound postlarvae with *Ammodytes dubius*. J. Northw. Atl. Fish. Sci. 3(2): 93-104.

561. Richards, S.W., and A.W. Kendall, Jr. 1973. Distribution of sand lance, *Ammodytes* sp., larvae on the continental shelf from Cape Cod to Cape Hatteras from *RV Dolphin* surveys in 1966. Fish. Bull., U.S. 71(2): 371-386.

562. Richards, S.W., J.M. Mann, and J.A. Walker. 1979. Comparison of spawning seasons, age, growth rates, and food of two sympatric species of searobins, *Prionotus carolinus* and *Prionotus evolans*, from Long Island Sound. Estuaries 2(4): 255-268.

563. Rinaldo, R.G. 1971. Analysis of *Morone saxatilis* and *Morone americanus* spawning and nursery area in the York-Pamunkey River, Virginia. M.A. thesis, Virginia Inst. Marine Science, Coll. William and Mary, Gloucester Pt., VA. 56 p.

564. Ritchie, T.P., and R.A. Beck. 1972. The history and 1972 status of oysters in Delaware. Delaware Dept. Natural Resources and Environmental Control, Div.Fish and Wildlife, Technical Services Sec.

565. Roberts, S.C. 1978. Biological and Fisheries Data on Northern Searobin, *Prionotus carolinus* (Linnaeus). NOAA/NMFS Tech. Ser. Rep. No. 13. 53 p.

566. Robinette, H.R. 1983. Species profiles: life histories and environmental requirements of coastal fishes and invertebrates (Gulf of Mexico) - bay anchovy and striped anchovy. U.S. Fish Wildl. Serv. Biol. Rep. 82(11.14). U.S. Army Corps of Engineers, TR EL-82-4. 15 p.

567. Rodhouse, P.G., J.H. McDonald, R.I. Newell, and R.K. Koehn. 1986. Gamete production, somatic growth and multiple-locus enzyme heterozygosity in *Mytilus edulis*. Mar. Biol. 90: 209-214.

568. Roegner, G.C. 1988. The establishment of intertidal populations of *Crassostrea virginica* in the York River, Virginia: A result of settlement or recruitment. J. Shellfish Res. 7(3): 550.

569. Roegner, G.C. 1989. Recruitment and growth of juvenile *Crassostrea virginica* (Gmelin) in relation to tidal zonation. M.A. thesis, Virginia Inst. Marine Science, Coll. William and Mary, Gloucester Pt., VA. 42 p.

570. Rogers, C.A. 1976. Effects of temperature and salinity on the survival of winter flounder embryos. Fish. Bull., U.S. 74: 52-58.

571. Rogers, Golden, and Halpern, Inc. 1990. Profile of the Barnegat Bay. Prepared for the Barnegat Bay Study Group by Rogers, Golden, and Halpern, Inc., in association with Expert Information Systems, Inc.

572. Rogers, S.G., and M.J. Van Den Avyle. 1983. Species profiles: life histories and environmental requirements of coastal fishes and invertebrates (South Atlantic) - Atlantic menhaden. U.S. Fish Wildl. Serv. Biol. Rep. 82(11.11). U.S. Army Corps of Engineers, TR EL-82-4. 20 p.

573. Rogers, S.G., and M.J. Van Den Avyle. 1983. Species profiles: life histories and environmental requirements of coastal fishes and invertebrates (South Atlantic) - summer flounder. U.S. Fish Wildl. Serv. Biol. Rep. 82(11.15). U.S. Army Corps of Engineers, TR EL-82-4.

574. Rogers, S.G., and M.J. Van Den Avyle. 1989. Species profiles: life histories and environmental requirements of coastal fishes and invertebrates (Mid-Atlantic) - Atlantic menhaden. U.S. Fish Wildl. Serv. Biol. Rep. 82(11.108). U.S. Army Corps of Engineers, TR EL-82-4. 23 p.

575. Rothschild, B.J. 1989. Development of a sampling expert system: "Fishmap". Final report to Maryland Dept. Natural Resources and U.S. Fish and Wildlife Service., Proj. No. F1710-89-008. 600 p.

576. Rothschild, B.J., J.S. Ault, G.T. DiNardo, C.I. Zhang, B. Huang, L. Baylis, and H. Li. 1991. Program Development for Efficient Fish Sampling and Stock Assessment in the Northern Chesapeake Bay. Univ. Maryland, Center for Environmental and Estuarine Studies, Solomons Island, Md.

577. Rountree, R.A., and K.W. Able. 1992. Fauna of polyhaline subtidal marsh creeks in southern New Jersey: composition, abundance and biomass. Estuaries 15(2): 171-185.

578. Rountree, R.A., and K.W. Able. 1992. Foraging habits, growth, and temporal patterns of salt-marsh creek habitat use by young-of-year summer flounder in New Jersey. Trans. Am. Fish. Soc. 121(6): 765-776.

579. Rozas, L.P., and W.E. Odum. 1987. Fish and macrocrustacean use of submerged plant beds in tidal freshwater marsh creeks. Mar. Ecol. Prog. Ser. 38(2): 101-108.

580. Rozas, L.P., and W.E. Odum. 1987. The role of submerged aquatic vegetation in influencing the abundance of nekton on contiguous tidal fresh-water marshes. J. Exp. Mar. Biol. Ecol. 114(2,3): 289-300.

581. Rugolo, L. 1990. Maryland Juvenile Striped Bass Survey, 1970-1989. Unpublished data. Maryland Dept. Natural Resources, Annapolis, MD.

582. Ruzeki, E.P., and W.J. Hargis, Jr. 1989. Interaction between circulation of the estuary of the James River and transport of oyster larvae. *In* Neilson, B.J., A. Kuo, and J. Brubaker (eds.), pp. 255-279. Estuarine Circulation. Humana Press, Clifton, NJ. 377 p.

583. Ryer, C.H. 1981. The feeding ecology and trophic role of the northern pipefish, *Syngnathus fuscus*, in a lower Chesapeake Bay seagrass community. M.A. thesis, Virginia Inst. Marine Science, Coll. William and Mary, Gloucester Pt., VA. 77 p.

584. Ryer, C.H. 1988. Pipefish, *Syngnathus fuscus*, foraging: effects of fish size, prey size, and altered habitat complexity. Mar. Ecol. Prog. Ser. 48: 37-45.

585. Ryer, C.M., and R.J. Orth. 1987. Feeding ecology of the northern pipefish, *Syngnathus fuscus*, in a seagrass community of the Lower Chesapeake Bay. Estuaries 10(4): 330-336.

586. Ryer, C.H., J. Van Montfrans, and R.J. Orth. 1990. Utilization of a seagrass meadow and tidal marsh creek by blue crabs, *Callinectes sapidus*. 2. Spatial and temporal patterns of molting. Bull. Mar. Sci. 46(1): 95-104.

587. Sabo, B.D., and E.W. Rhodes. 1987. Indexed bibliography of the bay scallop (*Argopecten irradians*). NOAA Tech. Memo. NMFS-F/NEC-48. 55 p.

588. Sadler, P.W., J. Van Montfrans, and R.J. Orth. 1990. The spatial and temporal distribution of *Callinectes sapidus* megolopal settlement in the York River, Virginia, during September, 1985. Bull. Mar. Sci. 46(1): 251.

589. Sager, D.R., L.C. Woods III, and J.N. Kraueter. 1986. Survival of *Morone saxatilis* in low pH oligohaline waters. J. Wash. Acad. Sci. 76(4): 237-243.

590. Saila, S.B., D.B. Horton, and R.J. Berry. 1965. Estimates of the theoretical biomass of juvenile winter flounder required for a fishery in Rhode Island. J. Fish. Res. Bd. Canada 22: 945-954.

591. Saila, S.B., T.T. Polgar, D.J. Sheehy, and J.M. Flowers. 1972. Correlations between alewife activity and environmental variables at a fishway. Trans. Am. Fish. Soc. 101: 583-594.

592. Sandifer, P.A. 1972. Morphology and ecology of Chesapeake Bay decapod crustacean larvae. Ph.D. dissertation, Univ. Virginia, Charlottesville, VA. 532 p.

593. Sandifer, P.A. 1973. Effects of temperature and salinity on larval development of grass shrimp. *Palaemonetes vulgaris* (Decapod, Caridea). Fish. Bull., U.S. 71(1): 115-121.

594. Saucerman, S.E. 1990. Movement, distribution and productivity of post-metamorphic winter flounder in different habitat types in Waquoit Bay, Massachusetts. M.S. thesis, Univ. Massachusetts, Amherst, MA.

595. Saucerman, S.E., and L.A. Deegan. 1991. Lateral and cross-channel movement of young-of-the-year winter flounder (*Pseudopleuronectes americanus*) in Waquoit Bay, Massachusetts. Estuaries 14: 440-446.

596. Saunders, W.P. 1984. Effects of anadromous restoration programs on the population dynamics of American shad (*Alosa sapidissima*) in the Connecticut River. M.S. thesis, Univ. Massachusetts, Amherst, MA. 103 p.

597. Savoy, T.F., and V.A. Crecco. 1988. The timing and significance of density-dependent and density-independent mortality of American shad, *Alosa sapidissima*. Fish. Bull., U.S. 86: 467-481.

598. Schaefer, R.H. 1965. Age and growth of the northern kingfish in New York waters. N.Y. Fish Game J. 12(2): 191-216.

599. Schaefer, R.H. 1967. Species composition, size and seasonal abundance of fish in the surf waters of Long Island Sound. N.Y. Fish Game J. 14(1): 1-46.

600. Schill, W.B., and R.M. Dorazio. 1990. Immunological discrimination of Atlantic striped bass stocks. Trans. Am. Fish. Soc. 119: 77-85.

601. Schreiber, R.A. 1973. The Fishes of Great South Bay. M.S. thesis, State Univ. New York, Stony Brook, NY. 199 p.

602. Schubel, J.R., T.R. Bell, and H.H. Carter (eds.). 1991. The Great South Bay. State Univ. New York, Marine Sciences Research Center, Stony Brook, NY. 107 p.

603. Schwartz, F.J. 1961. Fishes of Chincoteague and Sinepuxent Bays. Am. Midl. Naturalist 65(2):384-408.

604. Schwartz, F.J. 1961. Lampreys and eels. Md. Conservationist 38(2): 18-27.

605. Schwartz, F.J. 1964. Fishes of Isle of Wight and Assawoman Bays near Ocean City, Maryland. Chesapeake Sci. 5(4):172-193.

606. Schwartz, F.J. 1965. Inter-American migrations and systematics of the western Atlantic cownose ray, *Rhinoptera bonansus* (Abstract). 6th Mtg. Assoc. Isl. Mar. Lab. Caribb., Isla Margarita, Venezuela, January 20-22, 1965.

607. Schwartz, F.J. 1968. Bull minnows. Md. Conservationist 4(3): 2-5.

608. Schwartz, F.J., and M.D. Dahlberg. 1978. Biology and ecology of the Atlantic stingray, *Dasyatis sabina* (Pisces:Dasyatidae), in North Carolina and Georgia. Northeast Gulf Sci. 2(1): 1-23.

609. Scoles, D.R. 1990. Stock identification of weakfish, *Cynoscion regalis*, by discriminant function analysis of morphometric characters. M.A. thesis, Virginia Inst. Marine Science, Coll. William and Mary, Gloucester Pt., VA.

610. Scott, R.F., and J.G. Boone. 1973. Fish distribution in various areas of Maryland tidewater as derived from shore-zone seining 1956-1972. Md. Dept. Nat. Res., Fisheries Admin., Annapolis, MD. Data Rep. MFA-73-1.

611. Scotton, L.N. 1970. Occurrence and distribution of larval fishes in the Rehoboth and Indian River Bays of Delaware. M.S. thesis, Univ. Delaware, College of Marine Studies, Lewes, DE.

612. Sedlmayer, S.T. 1988. Early life history of weakfish, *Cynoscion regalis*. Ph.D. dissertation, Virginia Inst. Marine Science, Coll. William and Mary, Gloucester Pt., VA.

613. Sellers, M.A., and J.G. Stanley. 1984. Species profiles: life histories and environmental requirements of coastal fishes and invertebrates (North Atlantic) - American oyster. U.S. Fish Wildl. Serv. Biol. Rep. 82(11.23). U.S. Army Corps of Engineers, TR EL-82-4.

614. Serchuk, F.M. 1972. The biology of the cunner, *Tautogolabrus adspersus*, in the Weweantic River estuary, Wareham, Massachusetts. M.S. thesis, Univ. Massachusetts, Amherst, MA. 111 p.

615. Serchuk, F.M. 1974. Age and growth of the cunner in the Weweantic River Estuary, Massachusetts. Chesapeake Sci. 15: 205-213.

616. Sette, O.E. 1943. Biology of the Atlantic mackerel (*Scomber scombrus*) of North America, Part I: Early life history, including the growth, drift, and mortality of the egg and larval populations. Fishery Bulletin 38. U.S. Fish Wildl. Serv., Fish. Bull. 50.

617. Sette, O.E. 1950. Biology of the Atlantic mackerel (*Scomber scombrus*) of North America, Part II: Migrations and habits. Fishery Bulletin 49. U.S. Fish Wildl. Serv. Fish. Bull. 51: 251-358.

618. Setzler, E.M., J.A. Mihursky, K.V. Wood, W.R. Boynton, T.T. Polgar, and G.E. Drewry. 1981. Major features of ichthyoplankton populations in the Upper Potomac estuary: 1974-76. The Early Life History of Fish: Recent Studies. Rapp. P.-V. Reun. Ciem. 178: 204-206.

619. Setzler-Hamilton, E.M. 1987. Utilization of Chesapeake Bay by early life history stages of fishes. *In* Majumdar, S.K., L.W. Hall, Jr., and H.M. Austin (eds.), pp. 63-69. Contaminant Problems and Management of Living Chesapeake Bay Resources. Pennsylvania Acad. Sci., Easton, PA.

620. Shaw, W.N., and F. Hammons. 1974. The present status of the soft-shelled clam in Maryland. U.S. Fish Wildl. Serv., Spec. Sci. Rep. Fisheries No. 508. 5 p.

621. Shenker, J.M., D.J. Hepner, P.E. Frere, L.E. Currence, and W.W. Wakefield. 1983. Upriver migration and abundance of naked goby (*Gobiosoma bosci*) larvae in the Patuxent River estuary, Maryland. Estuaries 6(1): 36-42.

622. Shepherd, G., and C.B. Grimes. 1983. Geographic and historic variations in growth of weakfish, *Cynoscion regalis*, in the middle Atlantic bight. Fish. Bull., U.S. 81(4): 803-813.

623. Shepherd, G.R., and C.B. Grimes. 1983. Reproduction of weakfish, *Cynoscion regalis*, in the New York bight and evidence for geographically specific life history characteristics. Fish. Bull., U.S. 82(3): 501-511.

624. Shirey, C.A. 1991. Stream and inland bays fish survey. An inventory of fishes and macroinvertebrates in Delaware's streams. Delaware Dept. of Natural Resources and Environmental Control. Project No. F-37-R.

625. Shirley, M.A. 1990. Habitat selection by molting and mating blue crabs. Bull. Mar. Sci. 46(1): 250.

626. Scherer, M. 1974. Brayton Point Investigations: Mount Hope Bay Ichthyoplankton Data. Marine Research, Inc., East Wareham, MA.

627. Scherer, M. 1974. Rome Point Investigations: Narragansett Bay Ichthyoplankton Survey. Marine Research, Inc., Falmouth, MA.

628. Shumway, S.E., H.C. Perkins, D.F. Schick, and A.P. Stickney. 1985. Synopsis of biological data on the pink shrimp, *Pandalus borealis*. NOAA Tech. Rep. NMFS 30. FAO Fisheries Synopsis No. 144. 57 p.

629. Sieling, F.W. 1960. The resources of Worcester County coastal waters - a summary of existing data, January 1960. Maryland Dept. of Research and Education, Ref. 60-10.

630. Sisson, R.T. 1974. The growth and movement of scup in Narragansett Bay, Rhode Island and along the Atlantic Coast. Rhode Island Dept. Natural Resources, Div. Fish and Wildlife, Providence, R.I. Rhode Island Dept. Natural Resources. Prepared for NOAA/NMFS. NTIS Rep. No. NOAA-75020602. 21 p.

631. Smith, C.L. (ed.). 1988. Fisheries Research in the Hudson River. State Univ. New York Press, Albany, NY. 407 p.

632. Smith, E.M., and P.T. Howell. 1987. The effects of bottom trawling on American lobsters, *Homarus americanus*, in Long Island Sound. Fish. Bull., U.S. 85: 737-745.

633. Smith, H.M., and B.A. Beane. 1899. List of fishes known to inhabit the waters of the District of Columbia and vicinity. Bull. U.S. Fish Comm. 18(1898): 179-187.

634. Smith, J.W. 1979. Recreational Atlantic mackerel (*Scomber scombrus*) fishery in Virginia, 1978. Special Report in Applied Marine Science and Ocean Engineering (SRAMSOE) No. 223.

[illegible] Smith, J.W. 1980. The life history of the cownose ray, *Rhinoptera bonasus*, in lower Chesapeake Bay, with notes on the management of the species. M.A. thesis, Virginia Inst. Marine Science, Coll. William and Mary, Gloucester Pt., VA. 151 p.

636. Smith, J.W., and J.V. Merriner. 1986. Observations on the reproductive biology of the cownose ray, *Rhinoptera bonasus*, in Chesapeake Bay. Fish. Bull., U.S. 84(4): 871-877.

637. Smith, J.W., and J.V. Merriner. 1987. Age and growth, movements and distribution of the cownose ray, *Rhinoptera bonasus*, in Chesapeake Bay. Estuaries 10(2): 153-164.

638. Smith, R.W. 1987. Marine fish populations in Delaware Bay. Final report, April 1, 1982 through March 31, 1987. Univ. Delaware, Dingell-Johnson funding through Del. Div. Fish Wildl., Proj. No. F-34-R.

639. Smith, R.W., and F.C. Daiber. 1977. Biology of the summer flounder, *Paralichthys dentatus*, in Delaware Bay. Fish. Bull., U.S. 75(4), 823-830.

640. Smith, S.M. 1987. Reproductive ecology, population dynamics and seasonal movements of the hogchoker (*Trinectes maculatus*) in the Elizabeth River, Virginia. M.A. thesis, Virginia Inst. Marine Science, Coll. William and Mary, Gloucester Pt., VA.

641. Smith, T.I.J. 1985. The fishery, biology, and management of Atlantic sturgeon, *Acipenser oxyrhynchus*, in North America. North American Sturgeons: Biology and Aquaculture Potential. Environ. Biol. Fish. 6: 61-72.

642. Smith, T.I.J., and E.K. Dingley. 1984. Review of biology and culture of Atlantic (*Acipenser oxyrhynchus*) and shortnose sturgeon (*Acipenser brevirostrum*). J. World Maricult. Soc. 14: 210-218.

643. Smith, T.I.J., D.E. Marchette, and G.F. Ulrich. 1984. The Atlantic sturgeon fishery in South Carolina. N. Am. J. Fish. Manag. 4(2): 164-176.

644. Smith, W.G. 1965. A study of the scup (*Stenotomus chrysops*), based on data obtained from the catches of the 1963-64 winter trawl fishery. M.A. thesis, Virginia Inst. Marine Science, Coll. William and Mary, Gloucester Pt., VA. 42 p.

645. Smith, W.G., and A. Wells. 1977. Biological and Fisheries Data on Striped Bass, *Morone saxatilis* (Walbaum). NOAA Tech. Rep. NMFS-NEFC 4. 42 p.

646. Smith, W.G., and J.J. Norcross. 1968. The status of the scup (*Stenotomus chrysops*) in winter trawl fishery. Chesapeake Sci. 9(4): 207-216.

647. Smith, W.G., P. Berrien, D.G. McMillan, and A. Wells. 1981. The distribution, abundance and produciton of Atlantic cod and haddock larvae off Northeastern United States in 1978-1979 and 1979-1980. Intl. Coun. Expl. Sea, No. ICES-CM-1981/G:52.

648. Smith, W.G., D.G. McMillan, C. Obenchain, P. Rosenberg, A. Wells, M. Silverman, E. Baranowski, and M. Adamus. 1980. Spawning cycles of marine fishes off northeastern United States, based on broad scale surveys of eggs and larvae, 1977-79. ICES Council Meeting, Intl. Coun. Expl. Sea, Copenhagen, Denmark. 22 p.

649. Snelson, F.F., Jr., and S.E. Williams. 1981. Notes on the occurrence, distribution, and biology of elasmobranch fishes in the Indian River Lagoon System, Florida. Estuaries 4(2): 110-120.

650. Sogard, S.M., and K.W. Able. 1991. A comparison of eelgrass, sea lettuce macroalgae, and marsh creeks as habitats for epibenthic fishes and decapods. Estuarine Coastal Shelf Sci. 33: 501-519.

651. Sogard, S.M., K.W. Able, and M.P. Fahay. 1992. Early life history of the tautog *Tautoga onitis* in the Mid-Atlantic Bight. Fish. Bull., U.S. 90: 529-539.

652. Speir, H.J. 1987. Status of some finfish stocks in the Chesapeake Bay. Water, Air, and Soil Pollution 35: 49-62.

653. Speir, H.J. 1990. Maryland commercial landings data, 1975-1989. Unpublished data. Maryland Dept. Natural Resources, Annapolis, MD.

654. Speir, H.J. 1990. Survey and inventory of anadromous fish spawning areas, 1975-1979. Unpublished data. Maryland Dept. Natural Resources, Annapolis, MD.

655. St. Pierre, R.A. 1971. Age, growth, and mortality of the white perch *Morone americana* (Gmelin), in the James and York Rivers, Virginia. M.A. thesis, Virginia Inst. Marine Science, Coll. William and Mary, Gloucester Pt., VA. 27 p.

656. St. Pierre, R.A., and W.J. Hoagman. 1975. Drastic reduction of the white perch, *Morone americana*, population in the James River, Virginia. Chesapeake Sci. 16(3): 192-197.

657. Stanley, J.G. 1985. Species profiles: life histories and environmental requirements of coastal fishes and invertebrates (Mid-Atlantic) - hard clam. U.S. Fish Wildl. Serv. Biol. Rep. 82(11.41). U.S. Army Corps of Engineers, TR EL-82-4.

658. Stanley, J.G., and D.S. Danie. 1983. Species profiles: life histories and environmental requirements of coastal fishes and invertebrates (North Atlantic) - white perch. U.S. Fish Wildl. Serv. Biol. Rep. 82(11.7). U.S. Army Corps of Engineers, TR EL-82-4. 12 p.

659. Stanley, J.G., and R. DeWitt. 1983. Species profiles: life histories and environmental requirements of coastal fishes and invertebrates (North Atlantic) - hard clam. U.S. Fish Wildl. Serv. Biol. Rep. 82(11.18). U.S. Army Corps of Engineers, TR EL-82-4. 19 p.

660. Stanley, J.G., and M.A. Sellers. 1986. Species profiles: life histories and environmental requirements of coastal fishes and invertebrates (Gulf of Mexico) - American oyster. U.S. Fish Wildl. Serv. Biol. Rep. 82(11.64). U.S. Army Corps of Engineers, TR EL-82-4. 25 p.

661. Stanley, J.G., and M.A. Sellers. 1986. Species profiles: life histories and environmental requirements of coastal fishes and invertebrates (Mid-Atlantic) - American oyster. U.S. Fish Wildl. Serv. Biol. Rep. 82(11.65). U.S. Army Corps of Engineers, TR EL-82-4. 25 p.

662. Steimle, F.W., Jr. 1981. Trophic relationships of artificial reef fishes. ICES Council Meeting, Intl. Coun. Expl. Sea, Copenhagen, Denmark. 5 p.

663. Steimle, F.W., and R.B. Stone. 1973. Abundance and distribution of inshore benthic fauna off southwest Long Island, N.Y. NOAA Tech. Rep. NMFS SSRF-673. 50 p.

664. Steiner, W.W., J.J. Luczkovich, and B.L. Olla. 1982. Activity, shelter usage, growth and recruitment of juvenile red hake *Urophycis chuss*. Mar. Ecol. Prog. Ser. 7: 125-135.

665. Stewart, L.L., and P.J. Auster. 1987. Species profiles: life histories and environmental requirements of coastal fishes and invertebrates (North Atlantic) - Atlantic tomcod. U.S. Fish Wildl. Serv. Biol. Rep. 82(11.76). U.S. Army Corps of Engineers, TR EL-82-4.

666. Stiles, S., J. Choromanski, D. Nelson, J. Miller, R. Greig, and G. Sennefelder. 1991. Early reproductive success of the hard clam (*Mercenaria mercenaria*) from five sites in Long Island Sound. Estuaries 14: 332-342.

667. Stolgitis, J.A. 1970. Some aspects of the biology of the tautog from Weweantic River estuary, Massachusetts, 1966. M.S. thesis, Univ. Massachusetts, Amherst, MA. 48 p.

668. Stolte, L., and S. Rideout. 1989. Salmon for the future. The Atlantic Salmon Journal, Spring 1989: 20-21.

669. Stout, A. 1986. A miracle in the making. The Atlantic Salmon Journal, Summer 1986: 13-16.

670. Sullivan, L. 1980. Distribution, abundance, and mortality estimates of larval butterfish, *Peprilus triacanthus*, from MARMAP surveys, 1977 and 1978. ICES Council Meeting, Intl. Coun. Expl. Sea, Copenhagen, Denmark. 12 p.

671. Sutter, F.C., R.S. Waller, and T.D. McIlwain. 1986. Species profiles: life histories and environmental requirements of coastal fishes and invertebrates (Gulf of Mexico) - black drum. U.S. Fish Wildl. Serv. Biol. Rep. 82(11.51). U.S. Army Corps of Engineers, TR EL-82-4. 11 p.

672. Talbot, C.W., and K.W. Able. 1984. Composition and distribution of larval fishes in New Jersey high marshes. Estuaries 7(4A): 434-443.

673. Talbot, C.W., K.W. Able, and J.K. Shisler. 1986. Fish species composition in New Jersey salt marshes: effects of marsh alterations for mosquito control. Trans. Am. Fish. Soc. 115: 269-278.

674. Tatham, T.R., D.J. Danila, D.L. Thomas, and Associates. 1978. Ecological Studies for the Oyster Creek Generating Station. Volume I: Fin- and shellfish. Progress report for the period September 1976-August 1977. Ichthyological Associates, Inc.

675. Tatham, T.R., D.J. Danila, D.L. Thomas, and Associates. 1978. Ecological Studies for the Oyster Creek Generating Station. Volume II: Plankton. Progress report for the period September 1976-August 1977. Ichthyological Associates, Inc.

676. Taylor, R.E., and J.M. Capuzzo. 1983. The reproductive cycle of the bay scallop, *Argopecten irradians irradians* (Lamarck), in a small coastal embayment on Cape Cod, Massachusetts. Estuaries 6: 431-435.

677. Tewksbury, H.T., and D.O. Conover. 1987. Adaptive significance of intertidal egg deposition in the Atlantic silverside, *Menidia menidia*. Copeia 1987(1): 76-83.

678. Thomas, D.L. 1971. An ecological study of the Delaware River in the vicinity of Artificial Island: The early life history and ecology of six species of drum (Sciaenidae) in the lower Delaware River, a brackish tidal estuary. Bull. No. 3, Ichthyological Associates, Inc.

679. Thorp, J.H., and D.E. Hoss. 1975. Effects of salinity and cyclic temperature on survival of two sympatric species of grass shrimp *Palaemonetes* and their relationship to natural distributions. J. Exp. Mar. Biol. Ecol. 18(1): 19-28.

680. Thorpe, L.A. 1991. Aspects of the biology of windowpane flounder, *Scophthalmus aquosus*, in the northwest Atlantic Ocean. M.S. thesis, Univ. Massachusetts, Amherst, MA. 101 p.

681. Topp, R.W. 1967. Biometry and related aspects of the biology of young winter flounder, *Pseudopleuronectes americanus*, in the Weweantic River Estuary. M.S. thesis, Univ. Massachusetts, Amherst, MA. 65 p.

682. Townes, H.K. 1939. Ecological studies on the Long Island marine invertebrates of importance as fish food or as bait. *In* Townes, H.K. (ed.), pp. 163-176. A Biological Survey of the Waters of Long Island Sound, 1938. New York Conservation Dept., Albany, NY.

683. Travelstead, J.G. 1980. Age determination and growth of the blueback herring, *Alosa aestivalis*. M.A. thesis, Virginia Inst. Marine Science, Coll. William and Mary, Gloucester Pt., VA. 60 p.

684. Tresselt, E.F. 1950. Spawning grounds of the striped bass or rock, *Roccus saxatilis* (Walbaum) in Virginia. M.A. thesis, Virginia Inst. Marine Science, Coll. William and Mary, Gloucester Pt., VA. 29 p.

685. Truitt, R.V. 1939. Our water resources and their conservation. Chesapeake Biological Laboratory, Solomons, MD. Contrib. No. 27. 103 p.

686. Tsimenides, N.C. 1970. Mortality rates and population size of the alewife *Alosa pseudoharengas* in the Rappahannock River and Potomac Rivers. M.A. thesis, Virginia Inst. Marine Science, Coll. William and Mary, Gloucester Pt., VA. 75 p.

687. Tucker, J.W., Jr. 1983. Energy utilization in bay anchovy and black sea bass eggs and larvae contrasting ecological roles. Ph.D. dissertation, Virginia Inst. Marine Science, Coll. William and Mary, Gloucester Pt., VA.

688. U.S. Fish and Wildlife Service. 1968. Fish and Wildlife Resources as Related to Water Pollution: Chesapeake Bay and Tributaries. U.S. Fish and Wildlife Service, Atlanta, GA. 183 p.

689. Ulanowicz, R.E., M.L. Ali, and W.A. Richkus. 1980. Assessing harvests of pelagic and invertebrate fisheries of northern Chesapeake bay in terms of environmental variations. ICES-CM-1980H:43. ICES Council Meeting, Intl. Coun. Expl. Sea, Copenhagen, Denmark.

690. Uphoff, J.H., Jr. 1989. Environmental effects on survival of eggs, larvae, and juveniles of striped bass in the Choptank River, Maryland. Trans. Am. Fish. Soc. 118(3): 251-263.

691. Valiela, I., K. Foreman, M. LaMontagne, D. Hersh, J. Costa, P. Peckol, B. DeMeo-Andreson, C. D'Avanzo, M. Babione, C. Sham, J. Brawley, and K. Lajtha. 1992. Couplings of watersheds and coastal waters: Sources and consequences of nutrient enrichment in Waquoit Bay, Massachusetts. Estuaries 15: 443-457.

692. Van Den Avyle, M.J. 1984. Species profiles: life histories and environmental requirements of coastal fishes and invertebrates (South Atlantic) - American eel. U.S. Fish Wildl. Serv. Biol. Rep. 82(11.24). U.S. Army Corps of Engineers, TR EL-82-4. 28 p.

693. Van Den Avyle, M.J. 1984. Species profiles: life histories and environmental requirements of coastal fishes and invertebrates (South Atlantic) - Atlantic sturgeon. U.S. Fish Wildl. Serv. Biol. Rep. 82(11.25). U.S. Army Corps of Engineers, TR EL-82-4. 17 p.

694. Van Den Avyle, M.J., and D.L. Fowler. 1984. Species profiles: life histories and environmental requirements of coastal fishes and invertebrates (South Atlantic) - blue crab. U.S. Fish Wildl. Serv. Biol. Rep. 82(11.19). U.S. Army Corps of Engineers, TR EL-82-4. 16 p.

695. Van Engel, W.A. 1958. The blue crab and its fishery in Chesapeake Bay. Comm. Fish. Rev. 20: 6-17.

696. Van Engel, W.A. 1987. Factors affecting the distribution and abundance of the blue crab in Chesapeake Bay. *In* Majumdar, S.K., L.W. Hall, Jr., and H.M. Austin (eds.), pp. 177-209. Contaminant Problems and Management of Living Chesapeake Bay Resources. Pennsylvania Acad. Sci., Easton, PA.

697. Van Housen, G. 1984. Electrophoretic stock identification of summer flounder, *Paralichthys dentatus*. M.A. thesis, Virginia Inst. Marine Science, Coll. William and Mary, Gloucester Pt., VA.

698. Vieira, J.P. 1991. Ecology of estuarine fish assembalges in Patos Lagoon, Brazil (32 S), and York River, USA (37 N), with review of zoogeography of fishes in western Atlantic warm-temperate and tropical estuaries. Ph.D. dissertation, Virginia Inst. Marine Science, Coll. William and Mary, Gloucester Pt., VA.

699. Vouglitois, J.J. 1983. The ichthyofauna of Barnegat Bay, New Jersey: relationships between long term temperature fluctuations and the population dynamics and life history of temperate estuarine fishes during a five year period, 1976-1980. M.S. thesis, Rutgers Univ., New Brunswick, NJ.

700. Vouglitois, J.J., K.W. Able, R.J. Kurtz, and K.A. Tighe. 1987. Life history and population dynamics of the bay anchovy in New Jersey. Trans. Am. Fish. Soc. 116(2): 141-153.

701. Waldman, J.R., D.J. Dunning, Q.E. Ross, and M.T. Mattson. 1990. Range dynamics of Hudson River striped bass along the Atlantic coast. Trans. Am. Fish. Soc. 119(5): 910-919.

702. Walford, L., S. Wilk, B. Olla, A. Kendall, B. Freeman, D. Deuel, and M. Silverman. 1978. The bluefish (*Pomatomus saltatrix*): A synoptic review of its biology. NOAA/NMFS NEFC Tech. Ser. Rep. Sandy Hook Lab., Highlands, NJ.

703. Walker, R.L., and C.M. Humphrey. 1984. Growth and survival of the northern hard clam *Mercenaria mercenaria* from Georgia, Virginia, and Massachusetts in coastal waters. J. Shellfish Res. 4(2): 125-129.

704. Wallace, R.A., and K. Selman. 1981. The reproductive activity of *Fundulus heteroclitus* females from Woods Hole, Massachusetts, as compared with more southern locations. Copeia 1981(1): 212-215

705. Warkentine, B.E. 1987. A reevaluation of the karyotype of the Atlantic silverside, *Menidia menidia*. Copeia 1987(1): 222-224.

706. Warlen, S.M., and J.S. Burke. 1990. Immigration of larvae of fall/winter spawning marine fishes into a North Carolina estuary. Estuaries 13(4): 453-461.

707. Warner, W.W. 1976. Beautiful swimmers: Watermen, Crabs, and the Chesapeake Bay. Little, Brown and Co., Boston, MA. 304 p.

708. Wass, M.L. (ed.). 1972. A checklist of the biota of lower Chesapeake Bay with inclusions from the upper Bay and Virginian Sea. Virginia Inst. Marine Science, Gloucester Pt., VA. Spec. Sci. Rep. No. 65. 290 p.

709. Weaver, J.E. 1975. Food selectivity, feeding chronology and energy transformations of juvenile Alewife (*Alosa pseudoharengas*) in the James River near Hopewell, Virginia. Ph.D. dissertation, Univ. Virginia, Charlottesville, VA. 88 p.

710. Webster, D.A. 1982. Early history of the Atlantic salmon in New York. N.Y. Fish Game J. 29: 26-43.

711. Wehrtmann, I.S. 1990. Larval production of *Crangon septemspinosa* in waters adjacent to Chesapeake Bay, USA in relation to oceanographic conditions. ICES Council Meeting, Intl. Coun. Expl. Sea, Copenhagen, Denmark. 12 p.

712. Wehrtmann, I.S., and C. Stagg. 1990. Distribution of *Crangon septemspinosa* larvae off Chesapeake Bay, USA.: A comparison of field data and the results of a larval transport model. ICES Council Meeting, Intl. Coun. Expl. Sea, Copenhagen, Denmark. 10 p.

713. Weinrich, D.R., E.W. Franklin, S.P. Minkkenin, and T.A. Jarzynski. 1986. Investigation of American shad in the Upper Chesapeake Bay. Completion Report F-37-R. U.S. Fish and Wildlife Service. 73 p.

714. Weinrich, D.R., M.E. Dore, and S.P. Minkkenin. 1984. Investigation of American shad in the Upper Chesapeake Bay. Completion Report F-37-R. U.S. Fish and Wildlife Service. 53 p.

715. Weinrich, D.R., M.E. Dore, and S.P. Minkkenin. 1985. Investigation of American shad in the Upper Chesapeake Bay. Completion Report F-37-R. U.S. Fish and Wildlife Service. 65 p.

716. Weinrich, D.R., N.H. Butowski, E.W. Franklin, and J.P. Mowrer. 1987. Investigation of Anadromous Alosids. Completion report F-37-R. U.S. Fish and Wildlife Service.

717. Weinstein, M.P., and H.A. Brooks. 1983. Comparative ecology of nekton residing in a tidal creek and adjacent seagrass meadow: Community composition and structure. Mar. Ecol. Prog. Ser. 2(1): 15-27.

718. Weisberg, S.B. 1986. Competition and coexistence among four estuarine species of *Fundulus*. Am. Zool. 26(1): 249-257.

719. Weisberg, S.B., and A.J. Janicki. 1990. Summer feeding patterns of white perch, channel catfish, and yellow perch in the Susquehanna River, Maryland. J. Freshwater Ecol. 5(4): 391-405.

720. Weiss-Glanz, L.S., J.G. Stanley, and J.R. Moring. 1986. Species profiles: life histories and environmental requirements of coastal fishes and invertebrates (North Atlantic) - American shad. U.S. Fish Wildl. Serv. Biol. Rep. 82(11.59). U.S. Army Corps of Engineers, TR EL-82-4.

721. Wells, H.W. 1957. Abundance of the hard clam *Mercenaria mercenaria* in relation to environmental factors. Ecology 38(1):123-128.

722. Welsh, B.L. 1975. The role of grass shrimp, *Palaemonetes pugio*, in a tidal marsh ecosystem. Ecology 56: 513-530.

723. Wenczel, P., and S.T. Tettelbach. 1992. Long Island bay scallop reseeding efforts: life after the brown tide. *In* Blogoslawski, W.J. (ed.). Environmental Auditing: Aquaculture and Environmental Stewardship. Milford Shellfish Biology Seminar, 1991. Environmental Management, Milford, CT.

724. Wenner, C.A. 1972. Aspects of the biology and systematics of the American eel, *Anguilla rostrata*. M.A. thesis, Virginia Inst. Marine Science, Coll. William and Mary, Gloucester Pt., VA. 109 p.

725. Wenner, C.A., and J.A. Musick. 1974. Fecundity and gonad observations of the American eel, *Anguilla rostrata*, migrating from Chesapeake Bay, Virginia. J. Fish. Res. Board Can. 31: 1387-1391.

726. Wenner, C.A., and J.A. Musick. 1975. Food habits and seasonal abundance of the American eel, *Anguilla rostrata*, from the Lower Chesapeake Bay. Chesapeake Sci. 16(1): 62-66.

727. Werme, C.E., R.E. Hillman, A. Levandowski, J.A. Scanlon, and D.L. McGrath. 1983. Temporal and spatial distributions of life history stages of fish and shellfish in Northeast estuaries. Final report to NOAA/NOS Ocean Assessments Division. Battelle New England Marine Research Lab., Duxbury, MA. 559 p.

728. Weston, Inc. 1992. Delaware Inland Bays Estuary Characterizaton - Living Resources. Preliminary Draft Manuscript. Weston, Inc., West Chester, PA.

729. Wheatland, S.B. 1956. Oceanography of Long Island Sound, 1952-1954: Pelagic fish eggs and larvae. Bull. Bingham Oceanogr. Coll. 15: 234-314.

730. Whitcomb, J.P., and D.S. Haven. 1988. The location and topography of oyster reefs in the Rappahannock River estuary, Virginia. J. Shellfish Res. 7(3): 551.

731. White, R.L., J.T. Lane, and P.E. Hamer. 1969. Delaware Bay shad, *Alosa sapidissima*, tagging study - Final project report. New Jersey Div. Fish and Game, Misc. Rep. No. 3M. 6 p.

732. Wigley, S.E., and F.M. Serchuk. 1992. Spatial and temporal distribution of juvenile Atlantic cod *Gadus morhua* in the Georges Bank-Southern New England region. Fish. Bull., U.S. 90: 599-606.

733. Wilcox, J.R., and H.P. Jeffries. 1973. Growth of the sand shrimp, *Crangon septemspinosa*, in Rhode Island. Chesapeake Sci. 201-205.

734. Wilcox, J.R., and H.P. Jeffries. 1974. Feeding habits of the sand shrimp, *Crangon septemspinosa*. Biol. Bull. (Woods Hole) 146: 424-434.

735. Wiley, M.L., and J.G. Boone. 1973. Bluefish. *In* Lippson, A.J. (ed.), p. 40-41. The Chesapeake Bay in Maryland: An Atlas of Natural Resources. Johns Hopkins Univ. Press, Baltimore, MD.

736. Wilk, S.J. 1979. Biological and Fisheries Data on Weakfish, *Cynoscion regalis*. NOAA Tech. Rep. NMFS-NEFC 21. 51 p.

737. Wilk, S.J. 1981. Fisheries for Atlantic croaker, spot, and weakfish. *In* Clepper, H. (ed.). Marine Recreational Fisheries 6, Proceedings of the 6th Annual Marine Recreational Fisheries Symposium.

738. Wilk, S.J., and B.M. Baker. 1989. Results of a fish-megainvertebrate survey of the New York Bight apex, late summer 1983. Bull. N.J. Acad. Sci. 34: 1-13.

739. Wilk, S.J., W.W. Morse, D.E. Ralph, and T.R. Azarovitz. 1977. Fishes and associated environmental data collected in New York Bight, June 1974- June 1975. NOAA Tech. Rep. NMFS SSRF-716. 53 p.

740. Wilk, S.J., W.W. Morse, and L.L Stehlik. 1990. Annual cycles of gonad-somatic indices as indicators of spawning activity for selected species of finfish collected from the New York Bight. Fish. Bull., U.S. 88(4): 775-786.

741. Wilk, S.J., and M.J. Silverman. 1976. Fish and hydrographic collections made by the Research Vessels Dolphin and Delaware II during 1968-72 from New York to Florida. NOAA Tech. Rep. NMFS SSRF-697. 159 p.

742. Wilk, S.J., and M.J. Silverman. 1976. Summer benthic fish fauna of Sandy Hook Bay, New Jersey. NOAA Tech. Rep. NMFS SSRF-698. 16 p.

743. Williams, A.B. 1964. A postlarval shrimp survey in North Carolina. N.C. Dept. Cons., Div. Comm. Sports Fish., Spec.Sci. Rep. 3. 5 p.

744. Williams, A.B. 1965. Marine decapod crustaceans of the Carolinas. U.S. Fish. Wildl. Serv. Fish. Bull. 65: 1-298.

745. Williams, A.B. 1974. The swimming crabs of the genus *Callinectes* (Decapoda: Portunidae). Fish. Bull., U.S. 72(3): 685-798.

746. Williams, A.B. 1984. Shrimps, lobsters, and crabs of the Atlantic coast of the eastern United States, Maine to Florida. Smithsonian Inst. Press, Washington, DC. 550 p.

747. Wilson, J.S., R.P. Morgan, G.B. Gray, P.W. Jones, J. Lawson, and R. Lunsford. 1974. Potomac River fisheries study: Striped bass spawning stock assessment, interim data report. Prepared for Power Plant Siting Program, Md. Dept. of Natural Resources, by Univ. of Md., Center for Environmental and Estuarine Studies, Chesapeake Biological Lab., Solomons, MD. Ref. No. 74-91.

748. Wilson, J.S., R.P. Morgan, P.W. Jones, J. Lawson, R. Lunsford, and S. Murphy. 1975. Potomac River fisheries study: Striped bass spawning stock assessment, interim data report. Prepared for Power Plant Siting Program, Md. Dept. of Natural Resources, by Univ. of Md., Center for Environmental and Estuarine Studies, Chesapeake Biological Lab., Solomons, MD. Ref. No. 75-91.

749. Wilson, J.S., R.P. Morgan, P.W. Jones, H.R. Lunsford, J. Lawson, and S. Murphy. 1976. Potomac River fisheries study: Striped bass spawning stock assessment, final report 1975. Prepared for Power Plant Siting Program, Md. Dept. of Natural Resources, by Univ. of Md., Center for Environmental and Estuarine Studies, Chesapeake Biological Lab., Solomons, MD. UMCEES Ref. No. 76-14.

750. Winters, G.H. 1989. Life history parameters of sand lances (*Ammodytes* spp.) from the coastal waters of eastern Newfoundland. J. Northw. Atl. Fish. Sci. 9(1): 5-11.

751. Witherell, D.B., and B. Kynard. 1990. Vertical distribution of adult American shad in the Connecticut River. Trans. Am. Fish. Soc. 119(1): 151-155.

752. Wong, R.S.P. 1968. Age and growth of the northern searobin *Prionotus carolinus* (Linaaeus). M.A. thesis, Virginia Inst. Marine Science, Coll. William and Mary, Gloucester Pt., VA. 49 p.

753. Wood, C.E. 1967. Physioecology of the grass shrimp, *Palaemonetes pugio*, in the Galveston Bay estuarine system. Contrib. Mar. Sci. 12: 54-79.

754. Wyanski, D.M. 1990. Patterns of habitat utilization in 0-age summer flounder (*Paralichthys dentatus*). M.A. thesis, Virginia Inst. Marine Science, Coll. William and Mary, Gloucester Pt., VA. 42 p.

755. Wynes, D.L. 1981. Optimal foraging in the cunner, *Tautogolabrus adspersus*. Biol. Bull. (Woods Hole) 161: 332-333.

756. Young, B.H., K.A. McKown, V.J. Vecchio, and J.D. Sicluna. 1991. A Study of Striped Bass in the Marine District of New York VII. Annual Report, Project AFC-14-2. New York Dept. Environmental Conservation, Div. Marine Resources. 262 p.

757. Yuschak, P., and W.A. Lund. 1984. Eggs, larvae, and osteological development of the northern searobin, *Prionotus carolinus* (Pisces, Triglidae). J. Northw. Atl. Fish. Sci. 5(1): 1-15.

758. Zawacki, C.S., and P.T. Briggs. 1976. Fish investigations in Long Island Sound at nuclear power station site at Shoreham, New York. N Y. Fish Game J. 23: 34-50.

759. Zich, H.E. 1977. New Jersey anadromous fish inventory: the collection of existing information and field investigations of anadromous clupeid spawning in New Jersey. N.J. Dept. Environmental Protection, Div. Fish, Game, and Shellfisheries. Misc. Rep. No. 41.

☆ U.S. GOVERNMENT PRINTING OFFICE: 1994 — 300-566/04001

DEMCO

U.S. Department of Commerce
National Oceanic and Atmospheric Administration
National Ocean Service
Strategic Environmental Assessments Division, N/ORCA1
1305 East West Highway, 9th Floor
Silver Spring, Maryland 20910

Address Correction Requested
OFFICIAL BUSINESS

40

Book Rate